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NOT TOO MUCH.[1]

By MAURICE EWING,

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ON such an occasion as this, when one is privileged to introduce a topic for discussion, it is customary and proper to attempt to place the subject against its historical background. In this context, no student of physiology is allowed to forget that it was Claude Bernard who drew attention to the vital need for maintaining the constancy of what he called *"le milieu intérieur"*—the fluid medium which forms, for each of our body cells, its immediate environment. That was 100 years ago, and yet it is very nearly in my professional lifetime that surgeons have begun to appreciate the practical significance of his observations, and to realize how considerable may be the deviations from the normal pattern, after a surgical operation, in even the most healthy of persons. It is true that our understanding of these problems has improved in the years since the war, but it is proper that we should remind ourselves that, even now, our practice is based on rather crude studies of the accessible part of the extracellular fluid, and that we know remarkably little of the more subtle shifts of fluid and of salts across the cell membranes.

I am one of those unhappy people who trained in the era before the impact of biochemistry, certainly on the practice of surgery, had become considerable, and who has always been struggling to keep abreast of the applications of this new knowledge at the bedside. I trust that such a person is an anachronism among the younger surgeons, and that the shortcomings of many of the men of my vintage will do nothing more to encourage in our hospitals the emergence of doctors whose main rôle is the regulation of the administration of salt and water.

To underline my simplicity in this field, let me begin with Gamble's slightly fanciful concept of the multicellular marine organism, reared in the wide ocean since the beginning of time, but with an urge to see the world. You can picture him trundling rather awkwardly up the beach, for he has had the wisdom to take along with him some of his fundamental environment neatly contained inside a skin, so that his component cells can continue to enjoy the luxury of wallowing in the salt water to which they have, long since, become completely adapted.

It will be apparent that this change, from the limitless oceans to the cramped life inside the skin bag, presented great problems, and Nature was compelled to evolve a circulatory system to guarantee to every cell an unchanging fluid environment. But despite the complexity of this circulatory mechanism, we have come to realize that the

[1] Read at a plenary session on "Fluids and Electrolytes in Health and Disease", Australasian Medical Congress (B.M.A.), Tenth Session, Hobart, March 1 to 7, 1958.

shifts of fluid which occur between the various compartments are not only rapid but almost unbelievably large, so that every part of the body can be regarded, in a physico-chemical sense, as lying in the very closest proximity to every other. Use of the word "compartment" in this context should, of course, be quite unacceptable, for it suggests a state of affairs which is wholly different from the truth. However, it helps us to think of the fluid in the body as consisting of several component parts. Of these, it is the changes in the extracellular fluid which we find easiest to follow, and this compartment I plan to represent rather crudely as a water tank inside the body.

In health, this tank is filled by one tap, and by one tap only—namely, the gullet. In civilized society a single person—and he is the owner of the unit—controls what goes down this tube, and the amount of fluid which he allows to pass his lips is, in the main, determined by instinctive urgings which we call thirst (although I am told that it may also be in part determined by the more subtle urgings of the fluid itself).

The tank is drained by several outlets, of which the chief one is the kidney. The loss of fluid from this channel can always be measured with precision. The need for its careful recording may on occasions be vital, and exactness in its measurement and charting is the more necessary since extrarenal losses are widely variable, and at the amount lost in this way we can only make what we hope will be an intelligent guess.

Now, it is essential for the proper functioning of the body that the fluid in the tank should be kept at a certain optimum level, and to ensure this is, among even the most temperate of people, a tall order. Fortunately, nature has continued to retain control of the outlet taps, and has evolved a system which is beautifully balanced, and efficient, and accommodating over a remarkably wide range.

When the occasion requires, there operates a most effective system of fluid conservation. However, there is at all times a certain irreducible minimum output, which is determined by the need for the body to get rid of heat, no less than of the end products of nitrogen metabolism. To match this obligatory fluid loss, there is a physiological minimum of intake, and if we fail to make good this amount of fluid, the level in the tank will surely fall.

Equally, the body has a great ability to work off a water load, a capacity to which many Victorians pay urgent tribute every evening. There seems in such a robust people to be almost no limit to the body's ability to throw open the renal sluices. The physiological range over which the fluid control mechanism can function efficiently is a very large one, and this is an exceedingly important point to remember.

In disease, however—and for the purpose of this discussion I must reluctantly place surgery in this category—things are quite otherwise, and the range of efficient working of the fluid-balancing system may, in times of stress, be considerably reduced. This is all the more unfortunate since, in disease, fluid may leak out of the tank in large amounts. This happening may be dramatic in its development and devastating in its effect—as, for example, in an urgent hæmorrhage—or less immediately apparent, although no less formidable when, in intestinal obstruction, there is a widespread exudation of fluid into the intestine along its entire length. Two litres or more of fluid may be lost each day from a duodenal fistula.

Much more insidious is the iatrogenic leak from gastric or intestinal aspiration. Sometimes I imagine that we run the risk of coming to regard this loss as highly beneficial, and are encouraged to make it complete and continuous long after we have good reason to do quite otherwise. We have, in fact, extraordinarily little control over fluid losses, other than that which we exercise by the institution of gastric or intestinal suction.

However, it is important for those of us who are surgeons to remind ourselves (even in the humbling presence of physicians) that we must never be reluctant to play the plumber's role, for we can often hope to stop at least some of the leaks quite effectively by a biological plug. This would apply particularly to the closure of a duodenal fistula, or to its correction by the timely fashioning of a jejunostomy, which makes it possible to conserve fluid and salt by its collection above and its return for absorption into the small bowel below.

Our ability to control the output end is, however, distinctly limited, and in most cases we must be content to measure the losses, and to make them good by appropriate provision at the other end.

After surgical operations the gullet-tap—the safe tap, and the one that the patient likes—is often out of action and we are constrained to give fluid by some other route; most often it is the intravenous one. I am old-fashioned enough to believe that the intravenous route is sufficiently dangerous to be used only with great caution and with good reason.

The trouble often begins—and by trouble I mean the "intravenous drip"—with the anæsthetist, who wants a vein for his medication; it is perpetuated by the resident, accepted by the sister, condoned by the registrar, overlooked by the honorary, tolerated by the patient; but all too often, I fear, the whole manœuvre is to Nature wholly abhorrent.

How often do we encounter in routine hospital practice the unhappy patient whose convalescence is made uncomfortable by a long tender line of phlebitis in each arm? How often is the wound of the "cut down" at the ankle the last to heal? May I respectfully remind some of you that twenty years ago we conducted operations without the use of intravenous therapy? And may I, even at the risk of being called conservative or reactionary or even old, dare to point out that some of our patients miraculously survived?

Of course, it is true that we were in those happy days less enterprising in our surgery than we are today, and no doubt we lost from fluid and salt depletion many patients who in more modern times would certainly have survived. I do honestly believe, however, that we should be cautious in instituting intravenous therapy, and should do so only with very good reason, and that equally we should show some reluctance in its perpetuation. For the patient who has had a straightforward operation, and who will be able next day to begin taking fluid by mouth, it is totally unnecessary.

It is well known that after any surgical operation there is for some days a reduced urinary output. This is a fundamental happening which we can in no way alter, even by stepping up the intake of fluid both before and after operation. Now, should we make the mistake of misinterpreting this happening, and of making it the excuse for turning on the intravenous tap faster, the tank may well overflow.

This is, of course, a gross over-simplification, for we are concerned not only with amounts of fluid, but, even more important, with its salt content. We were often guilty in the past of being over-enthusiastic in giving isotonic saline intravenously, in large amounts, both during and after operation. We now know that this corresponded, in time, with a phase of sodium retention. Little wonder then that we sometimes precipitated pulmonary and peripheral œdema. When we learned of this risk, we changed our fluid to isotonic glucose solution, which contains no salt and which, after its sugar content has been metabolized, is water and only water.

Now a healthy person becomes nauseated and disinclined to drink when offered too much fluid, and I have already reminded you that he can in any event handle a heavy intake of water by a prompt diuresis. After operation, however, things are very different, for the body now has great difficulty in shedding the excess, and if the water load is too big, and especially if it is given by some abnormal route, the intravenous being by far the most common, the body fluids will inevitably become diluted.

The tonicity of the extracellular fluid depends on its sodium content, and as a measure of the hypotonicity which may occur in such cases, the serum sodium level may fall from the normal 140 to 120 milliequivalents per litre or even less. The condition may, for this reason, not unnaturally be mistaken for one of sodium depletion.

The excess water finds its way into all the compartments of the body fluid, so that œdema is not usually apparent. To this process of waterlogging the cells of the central nervous system appear to be peculiarly vulnerable.

Now, it will be clear that to reach such a serious degree of hypotonicity, a much smaller water load will be necessary if, at the same time, the patient has become depleted of sodium, a happening which is, of course, by no means uncommon in surgical practice.

This condition of overloading with water is called "primary water retention" or "water intoxication". It is most often met with as a neurological or psychological disturbance (Black, 1957) in the first 24 or 48 hours after operation, when fluids are pressed unwisely in the face of an inadequate urinary output.

In the severe case the onset may be dramatic, with generalized convulsions and coma. If the condition is not promptly recognized and equally promptly treated, the patient may well succumb. More often he becomes confused, irrational and difficult to manage, or alternatively unduly sleepy, weary and apathetic.

It is a condition which I confess I seldom recognize, but I have a strong feeling that I often overlook its milder manifestations. There will be in such cases no sign of dehydration, but well-filled veins, a reasonable blood pressure and a gain in weight. The most constant and the most significant biochemical finding is the low serum sodium value.

As always, the best treatment is prevention, and in this connexion Black's advice to restrict "the intake of non-saline fluid to an amount not exceeding the urine volume by more than a litre" is well worth remembering. Since the primary trouble is hypotonicity of the body fluid, isotonic saline will only increase the extracellular fluid volume still further. However, in a severe case with convulsions or coma, 50 cubic centimetres of a 5% solution of sodium chloride can be given intravenously every one or two hours. However, the dosage and the frequency of administration will be controlled by the response to treatment and by serial estimations of the serum sodium level.

Unfortunately, when we assume the responsibility after operation for supervising, as best we can, the various mechanisms which control the level of the fluid in the tank, we are often at the great disadvantage of starting off with one which is already half empty. It may be in fact *exceedingly difficult to know how much water is inside,* for it is an opaque container and we cannot even look in at the top. Nor will weighing help us much if we do not know what has gone before. It is true that we can aspirate samples from inside and, from this analysis, make deductions *which may lead us to the truth, but of the short*comings of single estimations we are all well aware.

Fortunately, there are changes, some of them in the appearance of the skin-bag itself, which reflect alterations in the amount of fluid inside, and these we have learned *to interpret in the light of experience. Such changes are* perhaps best exemplified in a case of acute obstruction of the small intestine, which is followed by repeated and copious vomiting. The eyes become sunken and the eyeballs soft. The tongue is harsh and dry; the skin quickly loses the resilience and turgor of health (but we must not mistake for this the wrinkling and inelasticity of the skin that go with advancing years). There is peripheral vasoconstriction, and the veins are empty and the blood pressure is low. This is the condition which we often call "dehydration", but incorrectly so, for true water depletion is not common in a surgical context. In this instance, it is the loss of sodium rather than of water which leads to a depletion of the extracellular fluid volume, and which may precipitate circulatory failure.

The important practical point to remember is that the diagnosis usually rests on other than biochemical findings, for a single estimation of the serum sodium content may well give a normal value and be no guide to us, even when we are confronted by very considerable deficiencies. But, even with the knowledge that the losses in such cases can be very large indeed, it may be unwise to spend too much time in their immediate intravenous replacement.

Operation is a matter of urgency, and the relief of the obstruction is as significant in the correction of fluid loss as ligation of the bleeding point is in the management of urgent hæmorrhage.

It is, however, when intestinal obstruction occurs after operation, or when other severe extrarenal losses develop—as, for example, in duodenal fistula—that we encounter the really formidable problems, for a leak at this stage may be from a tank in which the fluid may already have fallen to a low level. It is in the management of this kind of case that we perhaps too often err on the side of conservatism, for the body depletion of both fluid and of salt may be very large indeed.

Still, I venture to suggest that our errors in treatment are in the main more of commission than of omission, and that they are born very often of a most unwise and uncritical prescription on the basis of a single examination of the electrolytes. I would, for this reason, advocate once again a cautious policy in relation to intravenous therapy, and encourage you to resort to the intravenous route for the administration of salt and of fluid only when the patient's present condition and his future prospects seem to direct its use.

Remember the level in the tank. Do not fill it so fast that the outlet cannot keep pace, and remember that the outlet valve after operation is half closed anyway. When the tank has developed leaks, try to make an estimate of their *size and of their duration and to guess the level of fluid* remaining. Try to make good the present deficit. Measure accurately all losses, normal and abnormal, and replace them as they occur; but do not make the mistake of managing the fluid input by remote control guided only by analysis of the plasma electrolytes. Stand back, rather, so that more appears in the picture, and prescribe treatment from hour to hour in the light of experience and taking care not to give too little, make sure you do not give too much.

FLUID AND ELECTROLYTE METABOLISM IN CHILDHOOD IN HEALTH AND DISEASE.[1]

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THE special position of the subject of fluid and electrolyte metabolism in pædiatrics is due partly to the frequency of diseases in infancy which cause losses of body fluids, *but more particularly to the peculiar metabolism of small* children, which even in health demands a relatively high water intake. Gamble (1951) stated that a normal infant's daily water turnover was approximately one-half of its extracellular volume, an adult's one-seventh. Friis-Hansen (1954) injected heavy water into normal infants and normal adults and found that the half-time excretion was two days in the infants and 11 days in the adults. *It is easy to understand why, even under normal temperate* conditions, an infant deprived of water may die in two or three days, and if abnormal losses due to either climate or disease are superimposed, dehydration and even death can occur very rapidly. In the matter of dehydration, the pædiatrician is confronted with emergencies more often than his colleague in adult medicine. The high rate of water and, to a lesser degree, electrolyte turnover in infants compared to that in adults results from the following factors.

[1] Read at a plenary session on "Fluids and Electrolytes in Health and Disease", Australasian Medical Congress (B.M.A.), Tenth Session, Hobart, March 1 to 7, 1958.

1. An infant's basal energy requirements and expenditure are relatively higher than those of adults. More heat is produced, and more water is required for skin evaporation to maintain a normal body temperature.

2. The surface area of the skin and lungs of infants relative to body weight is considerably greater than in adults, and hence there is a proportionately greater water loss.

3. The proportion of body water in the extracellular compartment is relatively greater than in the cellular compartment in childhood, and in early infancy actually exceeds it. Figure I (from Friis-Hansen, 1954[1]) demonstrates the water distribution in childhood. The commonly accepted figures of total body water 70% and cellular water 50% of body weight are probably too high even for adults, and should be about 60% and 40% respectively from puberty onwards. It will be seen that nearly 80% of an infant's weight in the first few months of life is water, the extracellular water initially exceeding the intracellular water. This distribution is related to surface area, as about 90% of skin and non-fatty subcutaneous tissue is composed of extra-cellular fluid.

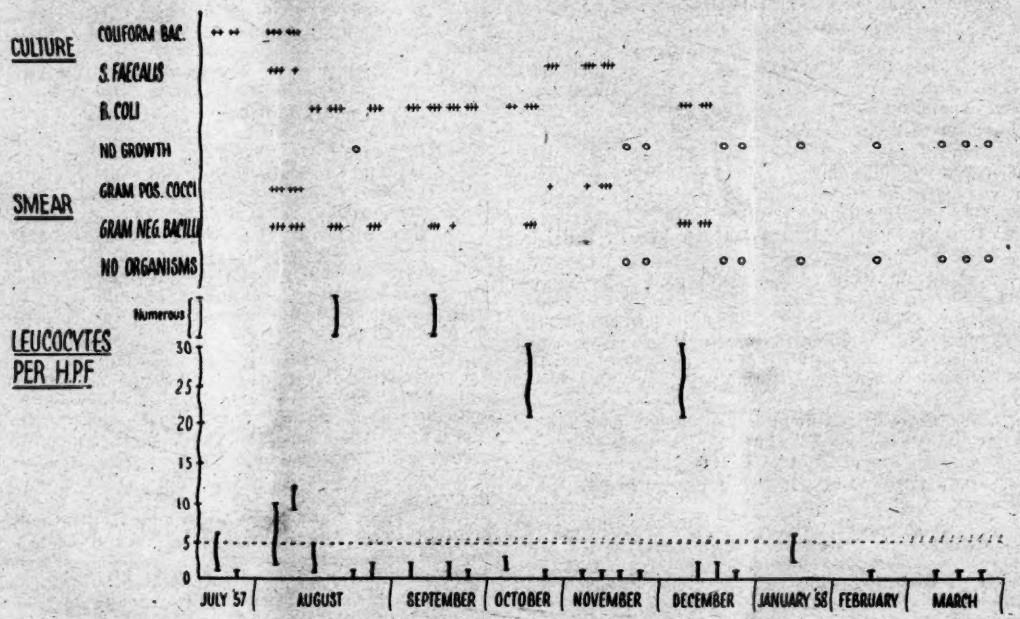

FIGURE I.

4. Infants are unable to excrete urine as concentrated as that of adults. The statement that infants' kidneys are generally immature has been criticized by McCance and Widdowson (1957). They have shown that the kidneys of new-born and growing animals are well adapted to preserve homœostasis in circumstances normal for them, and that incorrect standards for comparison with adults have been used in the past (McCance and Widdowson, 1952). Within this context, however, it is generally accepted that infants require relatively more water than adults to excrete metabolic waste and excess electrolytes.

Other components of water and electrolyte homœostasis are very similar in adults and children. The electrolyte patterns of the extracellular fluids differ, in that the bicarbonate content is slightly lower and chloride content is slightly higher; but neither total osmolarity nor buffering capacity is altered thereby, and the pH remains in the normal range of 7·35 to 7.45. Apart from volume, physico-chemical standards relative to age have not been determined for cellular fluid.

[1] By courtesy of the publishers, Schwabe, of Basel, Switzerland.

Dehydration from Water Loss.

It must be evident that even in a temperate environment a healthy infant is more susceptible to water deprivation than an adult. In climatic conditions such as an Australian summer, sweating is added to insensible skin loss. Restlessness will raise the metabolic rate, and crying will increase evaporation from the lungs. There is an obligatory loss of water in urine when nitrogen excretion is minimal, as in an infant given glucose water. If a feeding with a high protein and electrolyte content is given, as in cow's milk, the urine water required to get rid of nitrogenous waste and excess electrolytes is much higher, especially in very young infants. A healthy infant who has lost water thus is very thirsty, and if water is offered to him, he will drink eagerly. If an infant is unable to remain in water balance because of neglect or because of an illness with pyrexia, anorexia or vomiting, dehydration will ensue, and if there is also diarrhœa or polyuria the dehydration will be accelerated. The initial water loss is borne by the extracellular fluid, which becomes hypertonic. This in turn causes a movement of water from cells, the extracellular volume and hence the blood volume is supported, and circulatory failure is averted temporarily. As much as 20% of body weight may be lost before circulatory collapse occurs. This type of dehydration due to predominant water loss is called hypertonic or hyperelectrolytæmic, because serum electrolyte concentrations are raised. In the acute form it is quite common during the Australian summer, and can be identified by a history of rapid onset, usually with interrupted oral fluid intake. An infant with acute water depletion is thirsty and irritable, but has a well sustained circulation and skin elasticity despite considerable weight loss (Laron, 1957). With a good history and examination, serum electrolyte analyses are seldom necessary. Treatment consists of the administration of one-fifth to one-quarter isotonic sodium chloride solution made isotonic with glucose, as it is unusual to have water loss alone. Distortion of acid-base equilibrium or potassium depletion rarely occurs.

Dehydration with Electrolyte Loss.

In environmental conditions in which water loss is not so acute, dehydration may take longer to develop—e.g.,

from diarrhœa, vomiting, ileus; but a continued loss of electrolytes may gradually undermine homœostasis to a much greater degree. Water loss may still outstrip electrolyte loss, so that a "cross section" estimation of serum electrolytes may reveal hyperosmolarity. Conversely, water taken by mouth or weak milk feedings may be retained and electrolyte depletion exceed water loss. In such a case the extracellular fluid becomes hypotonic, and a normal physiological response with inhibition of posterior pituitary antidiuretic hormone and excretion of water quickly restores extracellular osmolarity, but at the expense of volume. If this cycle is repeated, a stage is reached at which further contraction of the extracellular space, including the vascular compartment, would cause peripheral circulatory failure. To avoid this, one homœostatic component—namely, volume—takes precedence over another—namely, osmolarity—probably through the medium of a volume receptor and the adrenal cortex, and the circulation is insecurely maintained at the expense of a progressively more dilute extracellular fluid. Water then shifts into cells, and not only do the cells become waterlogged, but the precariously held extracellular volume further decreases.

When there has been appreciable sodium loss, the extracellular fluid and plasma may be hypertonic, isotonic or hypotonic, according to the differential water loss, and these variants of osmolarity are reflected in the cells, which may be dehydrated or waterlogged, and in either case show a total reduction of their metabolic function. In contrast to the uncomplicated picture of water loss the peripheral circulation is not maintained, and hypoxia of essential systems results. Accompanying the dehydration of electrolyte depletion there often occur acidosis or alkalosis, disorganization of intracellular substance, depression of enzyme systems and migration of intracellular electrolyte, notably potassium. Homœostasis gives way to chaos, and a critical stage is reached at which the nervous system, endocrines and kidneys are incapable of further adjustments. Electrolytes as well as water are excreted in the urine, because tubular reabsorption has failed (Kerpel Fronius, 1935). Peripheral circulatory failure rapidly follows, and the resultant hypoxia soon causes irreversible "shock" and death. Infants with dehydration resulting from electrolyte depletion are more ill than those with water depletion. They are pale, clammy, limp and apathetic, with rapid thready pulses, and may have cyanotic mottling of the skin and cyanosis of the extremities. They appear more severely dehydrated than infants with water depletion who have lost the same amount of body weight, as the extracellular fluid, which comprises 90% of the skin and non-fatty subcutaneous tissue, has sustained most of the fluid loss (Laron, 1957). Frequently they have potassium depletion and a disarrangement of ionic relationships, with muscle hypotonia, ileus and dyspnœa. This type of dehydration can usually be identified clinically, but it is impossible to determine accurately from clinical examination alone whether the plasma sodium, chloride and potassium levels will be low, normal or high. Sometimes the nature and direction of the distorted electrolyte pattern may be predicted from an accurate history and a knowledge of the disordered physiology in those diseases which cause water and electrolyte loss. It has been found that infants in whom dehydration is superimposed on malnutrition are most likely to have hypotonic extracellular fluid (Metcoff, Frenk, Gordillo, Gomez, Ramos-Galvan, Cravioto, Janeway and Gamble, 1957). It has been shown recently that, in infants with electrolyte depletion, the hypertonic form of dehydration is more likely to end fatally than the hypotonic form (Boda and Kiss, 1954; Finberg and Harrison, 1955; Kerpel Fronius and Vonoczky, 1957). In both varieties the terminal anoxia seems to be the critical factor in untreated cases.

Unfortunately, the critical factor in treated cases is often the treatment itself. When an infant is severely ill, rapid hydration of already waterlogged neurons or removal of water from those already dehydrated, by the administration of hypotonic or hypertonic fluid respectively, may precipitate convulsions or coma which may be intractable and end fatally. I suppose every pædiatrician of experience has observed an infant have convulsions during therapy, and in many cases has attributed the convulsions to "toxæmia", when in fact the true cause has been acute aggravation of disorganized cell function as a result of therapy.

It is in such cases of severe dehydration, in which appreciable electrolyte loss is suspected from the history, that biochemical investigation of the plasma will be of great help; but in an emergency, treatment must not be withheld until biochemical findings are available. If the emergency is great enough to demand immediate therapy—i.e., peripheral circulatory failure when it appears that vasomotor collapse is added to fluid loss—rapid infusion of serum, plasma or dextran saline is most likely to maintain blood flow, and the suitable infusion solution can be substituted when information is available. With the assistance of a flame photometer, the plasma sodium level should be obtainable within half an hour. If it is elevated above 150 milliosmols per litre, a solution of one-quarter or one-half isotonic sodium chloride solution made isotonic with glucose should be given. If the level is depressed below 130 milliosmols per litre, isotonic sodium chloride solution should be given. If the plasma sodium level is within the range of 130 to 150 milliosmols per litre, the choice of infusion fluid is not so critical, but because of the total electrolyte depletion, it is better to give at least one-half isotonic sodium chloride solution. It is inadvisable to include sodium lactate or bicarbonate in the initial infusion, as alkaline solutions may aid sodium entry to and potassium exit from cells. McCance and Widdowson (1957) have recently demonstrated that sodium chloride is unlikely to do so. Even when there is strong evidence of potassium depletion, the introduction of potassium into fluids for an initial infusion is contraindicated whilst there is doubt about the circulation and the renal function. The only indication for any rapid infusion is actual or impending circulatory collapse. If an error in the choice of fluid has been made, a rapid aggravation of intracellular over-hydration or under-hydration may precipitate convulsions and coma, and even if the correct choice has been made, a rapid change of cell hydration even towards normal may have a similar effect (Weil and Wallace, 1956). Rehydration with the correct fluid is best accomplished in infants at a rate not greater than 180 millilitres per kilogram of body weight in 24 hours, and at a rate considerably less in neonates; but sometimes when there is a persistent fluid loss, it may be necessary to exceed this rate, in order to obtain a positive fluid balance. When hydration has been corrected, attention to restoration of acid-base balance and correction of potassium depletion is indicated. Further fluid is best administered as one-fifth to one-quarter isotonic saline with glucose. Potassium salts can then be given if necessary, preferably by mouth. Maintenance requirements of water and electrolytes depend on normal and abnormal daily losses (Table I). In surgical conditions, fluid sucked from the stomach or bowel can be measured and analysed. There is a tendency to become complacent once hydration has been restored; but a small patient can easily become œdematous. The slow response of the kidneys to a sodium load is well known; but it is less well recognized that there is a lower limit of urine osmolarity, and water given beyond this is retained, especially in young infants whose renal diluting capacity is also less than that of adults.

TABLE I.

Daily Maintenance Requirements of Healthy Infants and Children.

Age.	Water. (Millilitres per Kilogram.)	Sodium. (Milli-equivalents per Kilogram.)	Potassium. (Milli-equivalents per Kilogram.)	Chloride. (Milli-equivalents per Kilogram.)
First 5 days ..	40	Nil	Nil	Nil
Less than 1 year	160	3	2	2
1 to 2 years ..	120	2	1·5	1·5
2 to 4 years ..	100	2	1·5	1·5
10 years	70	1·5	1	1

Conclusion.

In this presentation I have not attempted to deal with individual illnesses causing fluid and electrolyte losses. I have tried to explain why the problem of dehydration is urgent in infancy, and why identification of the type of dehydration and its correct initial treatment are so important. These principles were recognized by Kerpel Fronius in 1935, but they made little impact on British medicine until Marriott's Croonian lectures in 1947. The situation in infants is more complex than in adults as described by Marriott, because of the more rapid and labile changes which I have mentioned. Thus, the electrolyte depletion syndrome can be subdivided into normo-electrolytæmic, hypo-electrolytæmic and hyper-electrolytæmic types, which require different initial managements. These sub-types are well accepted by pædiatricians dealing with fluid and electrolyte metabolism. I have tried to point out that an accurate history, a careful clinical examination and a knowledge of the disordered physiology will provide most of the answers, but that a serum sodium estimation may be of critical importance. This should be within the scope of all institutions dealing wth small children, now that inexpensive and reliable flame photometers are available. Analysis of the urine has little place in assessment for therapy nowadays. It is too much open to incorrect interpretation.

Summary.

1. Normal infants and small children have a greater rate of water turnover than adults because of their high metabolic rate, their relatively large surface area, their different distribution of water in fluid compartments and their immature renal concentrating power.

2. In illnesses associated with water and electrolyte losses, these differences are accentuated.

3. Water loss or deprivation causes more rapid but more easily correctable dehydration of the hypertonic type.

4. Electrolyte losses may cause a complicated clinical and biochemical picture, which requires more skill in diagnosis and management. Dehydration may be of the isotonic, hypotonic or hypertonic variety; these are not accurately distinguishable clinically.

References.

BODA, D., and KISS, A. (1954), *"Beziehungen zwischen Energieumsatz und Flüssigheitsaustausch der Zellen", Internat. Elektrolyt-Symposium*, Schwabe, Basel: 17.

FINBERG, L., and HARRISON, H. E. (1955), "Hypernatremia in Infants", *Pediatrics*, 16: 1.

FRIIS-HANSEN, B. (1954), "The Measurement of Total Body Water and Extracellular Fluid in Children", *Internat. Elektrolyt-Symposium*, Schwabe, Basel: 7.

GAMBLE, J. L. (1951), "Lane Medical Lectures: Companionship of Water and Electrolytes in the Organization of Body Fluids", Stanford Univ. Series, Medical Sciences, Volume V, Paper Number 1.

KERPEL-FRONIUS, E. (1935), *"Über die Beziehungen zwischen Salz und Wasserhaushalt bei experimentellen Wasserverlusten", Ztschr. Kinderh.*, 57: 489.

KERPEL-FRONIUS, E., and VONOCZKY, J. (1957), "Significance of Changes in the Tonicity of Body Fluids in Infantile Diarrhœal Dehydration", *Ann. pædiat. fenn.*, 3: 403.

LARON, Z. (1957), "Skin Turgor as a Quantitative Index of Dehydration in Children", *Pediatrics*, 19: 816.

MCCANCE, R. A., and WIDDOWSON, E. M. (1952), "The Correct Physiological Basis on which to Compare Infant and Adult Renal Function", *Lancet*, 2: 860.

MCCANCE, R. A., and WIDDOWSON, E. M. (1957), "New Thoughts on Renal Function in the Early Days of Life", *Brit. M. Bull.*, 13: 3.

MCCANCE, R. A., and WIDDOWSON, E. M. (1957), "Hypotonic Expansion of the Extracellular Fluids", *Acta pædiat.*, 46: 337.

MARRIOTT, H. L. (1947), "Water and Salt Depletion", *Brit. M. J.*, 1: 245.

METCOFF, J., FRENK, S., GORDILLO, G., GOMEZ, F., RAMOS-GALVAN, R., CRAVIOTO, J., JANEWAY, C. A., and GAMBLE, J. L. (1957), "Intracellular Composition and Homeostatic Mechanisms in Severe Chronic Infantile Malnutrition IV", *Pediatrics*, 20: 317.

WEIL, W. B., and WALLACE, W. M. (1956), "Hypertonic Dehydration in Infancy", *Pediatrics*, 17: 171.

PRACTICAL RADIATION PROTECTION.[1]

By ADRIAN JOHNSON,
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THE problems associated with protection against radiation have exercised the minds of those trained in its use ever since it was realized some sixty years ago that the misuse of ionizing radiation could have harmful effects. That injury can occur in the skin was recognized soon after Röntgen's discovery was applied. The possibility that harmful genetic effects and injury to the blood-forming organs might also result has come under lively discussion in recent years in both the medical and the lay Press. It is regrettable that in the case of the latter, sensationalism and political consideration rather than the provision of accurate information often seem to be the motivating factors. These possibilities have in fact been under scrutiny for many years, but not with the same sense of urgency as now.

A great difficulty is that the subject is discussed by those who have only a vague idea of what they are talking about with far more confidence than those who realize the limitations of our knowledge. For example, a senior physician informally discussing this subject recently admitted that he believed that when ionizing rays impinged on the body they "activated" the lymphocytes, which then circulated in the blood-stream emitting radiation. There is no doubt that this subject could be better dealt with in the medical curriculum. Most people do not appear to appreciate the difference between localized and whole-body irradiation, or between the effects of high and low voltage irradiation.

TABLE I.

Dose of Radiation to the Gonads Derived from Various Sources in Thirty Years. (*After* Martin.)

Source.	Dose. (Millirems.)	Percentage of Total.
Natural radiations	3000	31·1
Body radiations	1000	10·4
Occupational exposure	20	0·2
Diagnostic X rays	4760	49·5
Therapeutic radiations	830	8·6
Luminous watches	23	0·2

TABLE II.

Technique.[1]	Focal-Gonad Distance. (Cm.)	Dose. (*r.*)	"Gonad Dose." (*mr.*)
A: bare table	50	100	90
X: lead-covered table ..	50	100	40

[1] "A"=131 kilovolts peak, 5 milliampères, half-value layer of 1·9 millimetres of aluminium; "X"=70 kilovolts peak, 5 milliampères, half-value layer of 1·0 millimetre of aluminium; "*mr*"=milliröntgen (0·001*r*).

As was pointed out in the report to the Prime Minister of the National Radiation Advisory Committee, most of our information comes from the study of effects of high doses of radiation in lower animals, and the application of these results to man is subject to uncertainties.

In the circumstances, however, it is only prudent to keep the exposure of the genes of the population as a whole to a minimum. It is important to underline the phrase "the population as a whole". It is the dose to the whole population of and before reproductive age that is important, rather than that to an individual, who, it is stressed in the report by the Medical Research Council of Great Britain, "should not feel alarm on his own account for dosage up to

[1] Read at the annual meeting of the Dermatological Association of Australia (B.M.A.), on July 24, 1958, at Broadbeach, Queensland.

the doubling dose and some way beyond". The problem of those dealing with the care of sick people is different from those carrying out mass surveys of normal people. Thus, in the treatment of patients with malignant skin conditions in Australia we are dealing with a population usually beyond reproductive age. It should be noted that the Medical Research Council of Great Britain states that the doubling dose lies somewhere between 30 and 80*r* (30,000 and 80,000m*r*). There is a great deal of confusion even amongst medical men as to what is a doubling dose, and it may be wise at this stage to clarify its meaning by quoting from the following paragraphs from the "Report of the Medical Research Council on the Hazards to Man of Nuclear and Allied Radiations".

186. A more realistic estimate of individual genetical risk can be obtained from the figures given in paragraphs 141 to 150. For example, the ordinary risk that any pair of parents will produce a case of severe mental defect which survives is about one in 500. The increased proportional risk for parents in both of whom mutation rates have been doubled is three per cent.; this means that the risk of their having a child with severe mental defect which survives is one in 485. If only one parent is affected the risk would be increased by a factor of 1·5 per cent, so that the chance would then be about one in 493.

TABLE III.

Conditions of Test.[1]	Gonad Dose. (m*r*.)
Tube head uncovered:	
Technique X	52
Technique A	97
Lead on tube head:	
Technique X	45
Technique A	75

[1] See footnote to Table II.

255. We consider, therefore, that an individual could, without feeling undue concern about developing any of the delayed effects accept a total dose of 200*r* in his lifetime, in addition to radiation from the natural background, provided that this dose is distributed over tens of years and that the maximum weekly exposure, averaged over any period of 13 consecutive weeks, does not exceed 0·3*r*. We recommend, however, that the aim should always be to keep the level of exposure as low as possible.

TABLE V.

Technique.[1]	FSD Open. (Cm.)	FGD. (Cm.)	Lesion Dose. (*r*.)	"Gonad Dose." (m*r*.)
A	26·5	87	100	150
X	26·5	87	100	67

[1] See footnote to Table II.

260. We have concluded that doses up to, and somewhat beyond, the "doubling dose" need cause no undue concern to the individual as regards his own offspring. Further, we gave reasons for believing that the values for the doubling dose of radiation for human genes may be, in general, in the range of 30*r* to 80*r*. We consider, therefore, that an individual could reasonably accept a total dose to the gonads of not more than 50*r* from conception to the age of 30 years, in addition to that received from the natural background. There will be no undue risk to the offspring of parents over this age provided the rate of exposure laid down in paragraph 255 is not exceeded.

The sources of ionizing radiations to which man is subject in Australia have been set out by Martin (1958) as in Table I. In assessing the contributions from superficial therapy, Martin makes the following statement:

> For the calculations the following conditions were taken as average. In superficial therapy the area treated was considered to be 10 square centimetres, while in malignant and pre-malignant conditions the dose considered to have been delivered was 4000*r*, and in benign conditions it was 1000*r*. For deep therapy the dose considered for non-malignant conditions was 1200*r*, and

TABLE IV.

Technique.[1]	FSD.[2] (Cm.)	Field. (Cm.)	FGD.[2] (Cm.)	Lesion Dose. (*r*.)	"Gonad Dose." (m*r*.)
A	26·5	26·5 open	87	100	150
A	26·5	20·0 cone	87	100	105

[1] See footnote to Table II.

[2] "FSD", distance from focal spot to skin; "FGD", distance from focal spot to gonads.

TABLE VI.

Technique.[1]	Tube Position.	FSD Cone. (Cm.)	FGD. (Cm.)	Lesion Dose. (*r*.)	"Gonad Dose." (m*r*.)
A	Tilted away.	26·5	87	100	90
A	Tilted towards.	26·5	87	100	135

[1] See footnote to Table II.

TABLE VII.

Age. (Years.)	Technique.[1]	FSD. (Cm.)	FGD. (Cm.)	"Gonad Dose." (m*r*.)	Lesion and Area.	Lesion Dose. (*r*.)	Field Diameter. (Cm.)
s[2] 13	A	15·0	82	12	Plantar verruca.	1700	2·0
s 6	A	20·0	75	45	Epilation.	1600	—
s 5	A	20·0	75	15	Epilation.	1600	—
54	X	26·5	25	165	Eczema of groin.	100	10·0
11	A	15·0	75	37	Plantar verruca.	1700	1·5
8	A	15·0	75	0	Plantar verruca.	1700	1·5
17	X	26·5	75	135	Acne of face and back.	400	20·0
s 18	X	26·5	82	0	Acne of face.	400	20·0
66	A	15·0	75	6	Keratoacanthoma.	600	2·5
68	A	15·0	75	15	Rodent carcinoma of ear.	700	2·5
23	A	15·0	75	7	Plantar verruca.	1700	1·25
68	A	15·0	75	15	Rodent carcinoma of ear.	700	2·5
x (i)[2] 32	X	26·5	75	30	Dermatitis of hands.	50	20·0
x (ii) 47	X	26·5	50	165	Dermatitis of hands.	50	20·0
48	A	15·0	75	0	Rodent carcinoma of neck.	700	2·0
48	X	26·5	37	18	Psoriasis of knee.	50	10·0
58	A	15·0	75	30	Rodent carcinoma of leg.	700	3·0
54	A	15·0	75	0	Rodent carcinoma of lip.	600	2·0
x (ii) 30	A	15·0	75	30	Keloid of hand.	400	5·0
x (i) 30	A	15·0	75	7	Keloid of arm.	400	5·0

[1] See footnote to Table II.

[2] "*s*"=protected with lead rubber apron, remainder not protected; "*x*"=tilt of tube to gonad area (i) away, (ii) towards.

for malignant conditions it was 4500*r*, while the average area treated was taken as 100 square centimetres. In superficial X-ray treatments of the lower trunk in females it was assumed that one ovary was within the field in 50% of cases, while in deep therapy sterilization was assumed to result in all cases.

Martin's figures are taken from the practice of the Peter MacCallum Clinic. However, it would appear that this figure is far too high. The average dose for malignant and pre-malignant lesions in a survey carried out at the Royal Prince Alfred Hospital, Sydney, was 2700*r*, and for non-malignant lesions 870*r*. If plantar verrucæ are excluded, the average dose for the latter falls to 367*r* and the average field of irradiation in this condition is one square centimetre. As Martin has indicated elsewhere, the scatter of radiation outside the field decreases very markedly with decrease in the size of the field. Also, as the radiation used by dermatologists is usually of a lighter quality excited by lower voltage than that used by deep therapists, it is likely that his figures for dose scattered through the tissues are too high.

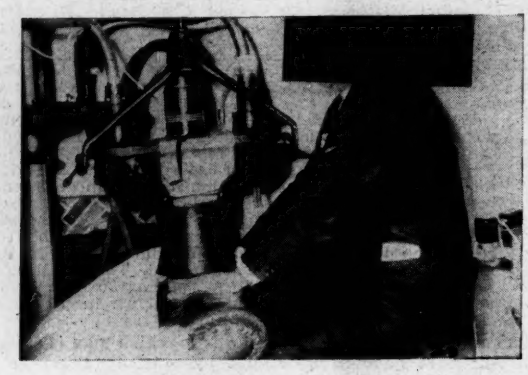

FIGURE I.

The tube is tilted away from the gonad area, but radiation is still scattered towards it. Note the lead protecting the filter X-ray opening.

It seems reasonable that if medical practice is to be conducted with one eye on statistics, it is essential that the primary information that is fed into the machine is beyond reproach. Whilst the clinician feels on unsafe ground in the field of mathematics, validity of these primary facts is very relevant.

Nevertheless, it is only wise to take heed of the recommendations of the National Radiation Advisory Committee to reduce by both administrative and technical means the radiation dose to the individual and to the population.

Now we have two alternatives. The first is to abandon completely the use of ionizing radiations. As Martin indicates in another paper, it is not within his province as a physicist to comment on the necessity for the use of radiation in the treatment of malignant or non-malignant conditions; but it goes without saying that the search for better methods of treatment of all disease goes on apace. Thus, in the treatment of pre-malignant lesions of the skin such as solar hyperkeratosis, dermatologists prefer the use of carbon dioxide acetone slush or the newer dermabrasion.

However, if we believe that superficial radiotherapy is still a useful weapon to employ in conjunction with other dermatological weapons in responsibly selected diseases, we can carry out paragraph 42 (ii) of the recommendations of the National Advisory Council by reducing dosage by technical means. This has also been requested by the United Nations Scientific Committee on the Effects of Atomic Radiation, paragraph 16:

> In particular it would be valuable to know how much the radiation to the gonads could be reduced (a) by improved design or shielding of equipment; (b) by fuller training of any individuals using radiographic or fluoroscopic equipment; and (c) by any local shielding of the gonads that is practicable, especially during abdominal or pelvic examination.

The work involved in the attempt to do this was carried out with a Philips pocket dosemeter, Q4423C, "Wat-Vic 'KX 140'" X-ray unit consisting of a KX 140 transformer and control, "SP 140" shockproof tube unit and a "Wat-Vic" number 38 mobile tube stand. First, to determine the approximate dose at the distance of the gonads, experiments were carried out by placing the dosemeter at the approximate distance from the focal spot to the gonads that it would ordinarily occupy. The dosemeter was placed at either end of the tube in order to determine any difference in scatter through the anode, but none was found. The dosemeter was laid on a table consisting of horsehair covered with leather. The underside of the table was covered with three-pound lead, which shut off scattered radiation from the floor; the "gonad dose" falls by 55% when the table is covered with lead in this fashion.

If the X-ray tube head and filter tray opening are enclosed with three-pound lead, as shown in Figure I, it is observed that the dose can be significantly reduced.

By the use of a cone to limit the field and not an open field, the dose can be reduced by 33%.

The effect of using a lower quality of radiation by lowering the kilovolts peak (KVP) is shown by a fall of 45% in the dose recorded at the gonad area. This may be significant in diagnostic radiology. A low "skin dose" achieved by filtration and a high KVP may mean a higher "gonad dose".

The effect of placing the tube so that it is not pointing in the general direction of the gonads is indicated by Table VI, which shows a 33% fall in dose level.

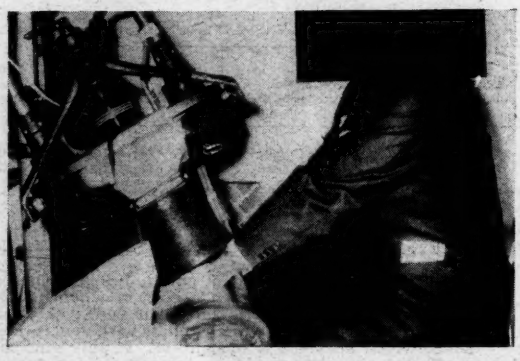

FIGURE II.

The tube is tilted towards the gonad area (exaggerated in illustration).

If the dosemeter is covered with lead rubber of 0·5 millimetre lead equivalent thickness, the dosemeter will not record. As the underside of the table is covered with lead, the area is virtually enclosed with lead. Now be sure this does not mean that none can reach the gonads, because some will be scattered through the tissues. The dosemeter used is not absolutely accurate for the quality of radiation reaching the gonad area, but it is the most accurate available to us and has been calibrated to the approximate dose. The important fact that emerges is that this dose can be reduced very considerably by various protective manœuvres.

Table VII consists of a selection from the dosemeter readings carried out during the actual treatment of 150 patients for various dermatological conditions, the dosemeter being placed either in contact with the scrotum or on the abdominal wall over the site of the ovaries.

From these readings will be seen the value of such protective measures as the tilt of the tube away from the gonad area; the dose can be lowered by as much as 84%. The posturing of the patient to attain this end is illustrated in Figures I to III, and can be carried out without a great deal of trouble. These same principles apply to diagnostic radiological technique.

The value of the use of lead rubber aprons is shown in the treatment of a patient with severe acne; the "gonad dose" was reduced from 135m*r* to the point where none was recorded.

The important fact that the dose of scattered radiation is lower if the field is smaller has been pointed out by Martin and Evans, and also by Stewart *et alii*, whose work with phantoms has led the field in work such as this in America, so that the smallest field possible is used. These

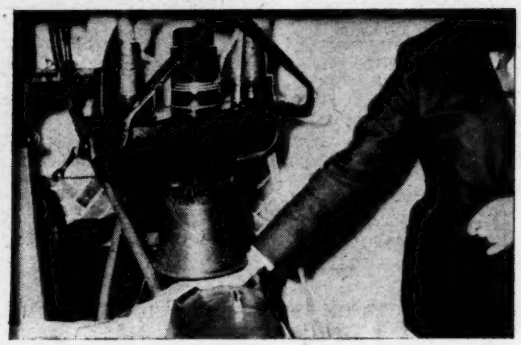

FIGURE III.

The patient is placed so that the gonad area is further removed from the field of irradiation. This is of importance in diagnostic radiological technique.

authors, in a paper which has arrived in Australia since this work was carried out, record similar findings, and also advocate the use of special lead cones to limit the field of irradiation.

Note also the higher dosage recorded in the treatment of areas near the gonads, such as the groins, because of radiation scattered from within the defined area through the tissues. Table VIII shows a similar selection from a

FIGURE IV.

The patient is still further protected by lead rubber apron and lead. He lies on a table covered with lead.

series of patients treated for various conditions, in which, in addition to a lead rubber apron, a sheet of three-pound lead was placed over the lower part of the trunk. This is found to be more efficient than two thicknesses of lead rubber. It is found, in most of these cases, that the dosemeter will simply not record, in spite of the fact that deflections of 2m*r* are obvious upon it.

Table IX shows the measurements recorded with the use of still lower voltage X rays and Grenz rays produced on a "Dermapan" machine.

Conclusion.

These simple studies underline the value of carrying out protective measures available to all who use ionizing radiations in either the diagnosis or the treatment of disease. In particular they make one "protection-conscious" both for the patient and for the operator. In fact the X-ray machine manufacturers are incorporating more protective measures in their new designs, both as regards leakage from the tube head and in the use of more adequate means of defining the field to be irradiated. The use of lower voltage radiation in the treatment of dermatological conditions has added advantages to those of low-tissue dose, outlined by Atkinson, in that a much smaller dose of radiation, and that of low energy, is scattered outside the defined field.

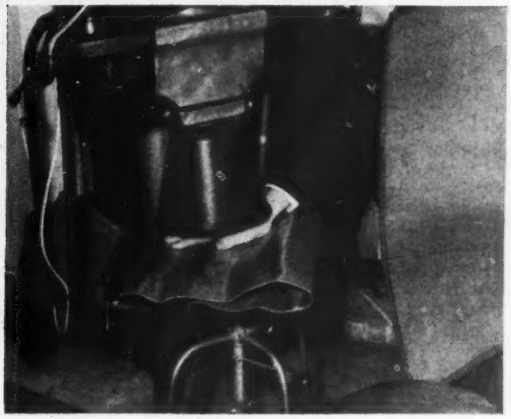

FIGURE V.

The patient, wearing a lead rubber apron, sits well out of line of the beam. The effect of covering of the table is shown by placing lead on the stool.

The use of a dosemeter, a simple and relatively inexpensive instrument, would appear to be a great help to all those operating X-ray equipment, diagnostic or therapeutic, not only in assessing the gonadal dosage to which patients are exposed, but also in the protection of their own persons. This is particularly so in the case of those physicians and surgeons who operate X-ray plants such as fluoroscopes, but are not specially trained in their use. A random survey

FIGURE VI.

The dosemeter.

shows that by easily corrected faults of technique, such as failure to adapt their eyes before fluoroscopic screening, they may be using higher outputs than is necessary. This and the failure to appreciate the effects of scattering may expose their patients and themselves to higher dosage than is necessary to achieve the same end.

Summary.

1. The possibility of harmful genetic effects from radiation is discussed.

2. The view is expressed that the contribution to gonad exposure from superficial radiotherapy has probably been overstated.

TABLE VIII.

Age. (Years.)	Technique.[1]	FSD. (Cm.)	FGD. (Cm.)	"Gonad Dose." (mr.)	Lesion.	Field Diameter. (Cm.)	Lesion Dose. (r.)
64	A	15·0	75	0	Carbuncle on arm.	5	200
64	A	15·0	75	15	Carbuncle on hip.	5	200
65	A	26·5	60	15	Eczema on legs.	20	50
30	X	26·5	75	0	Dermatitis of fingers.	10	50
40	X	26·5	75	0	Nummular eczema of hands.	20	50
x 24[2]	X	26·5	75	7	Eczema on hand.	20	50
a 24[2]	X	26·5	75	0	Eczema on hand.	20	50
x 55	X	26·5	75	15	Eczema on right arm.	20	50
a 55	X	26·5	50	0	Excema on left hand.	20	50

[1] See footnote to Table II.

[2] "*x*"=no protection, but patient lying with hand extended; "*a*"=lead-rubber apron and lead sheet.

3. The prudence of taking every precaution to reduce dosage is underlined.

4. The dose measured at the approximate gonad area in the treatment of a series of dermatological patients is listed.

5. Simple and easily applied methods by which this dose can be reduced to low or unmeasurable values are set out. The most important of these are the covering of the table with lead, the use of lead aprons, and the posturing of the patient.

6. The application of these measures by physicians carrying out diagnostic procedures, with accruing protection to their patients and themselves, is pointed out.

7. Mention is made of the value of the routine use of a dosemeter.

TABLE IX.
No Protection.

Step.	FGD. (Cm.)	Cone/ FSD.	HVL. (mm. of Aluminium.)	Field Dose. (r.)	"Gonad Dose." (mr.)
4	100	20/30	1·0	100	45
3	100	20/30	0·6	100	30
1 (Grenz)	87	—	—	100	0

Acknowledgements.

My thanks are due to Mr. B. W. Scott, of the New South Wales State Bureau of Physical Services, for calibrating the machine and the dosemeter and for much helpful advice, to Dr. John E. Cramer, who helped in these experiments, and to Dr. D. L. Green, medical officer in charge of the Radiotherapy Department of the Royal Prince Alfred Hospital, who helped in analysing the records of this department. I should also like to thank Mr. D. J. Stevens, the Director of the Commonwealth X-Ray and Radium Laboratories, and Dr. J. H. Martin, Physicist of the Peter MacCallum Clinic, for helpful discussion and advice. Thanks are due also to Dr. F. C. Florance, who allowed me to carry out measurements with his "Dermapan" machine.

References.

ATKINSON, H. R. (1957), "Tissue Dose in Dermatological X-Ray Therapy", *Australian J. Dermat.*, 4: 11.

MARTIN, J. H. (1957), "Necessity and Means of Protection of the Patient in Diagnostic and Therapeutic Radiology", *Proc. Coll. Radiologists Australia*, December.

MARTIN, J. H. (1958), "The Contribution to the Gene Material of the Population from the Medical Use of Ionizing Radiations", M. J. AUSTRALIA, 2: 79.

MARTIN, J. H., and EVANS, E. (1958), "Radiation Outside the Defined Field", *Brit. J. Radiol.*, in the press; personal communication.

REPORT TO THE PRIME MINISTER BY THE NATIONAL RADIATION ADVISORY COMMITTEE (1958), July, Melbourne.

STEWART, W. D., WITTEN, V. H., and SULZBERGER, M. B. (1958), "Studies on the Quantity of Radiation Reaching the Gonadal Areas during Dermatologic X-Ray Therapy: III. Shielding Technics and Other Precautions for Reducing Gonad Dose", *J. Invest. Dermat.*, 30: 237.

MEDICAL RESEARCH COUNCIL OF GREAT BRITAIN (1956), "The Hazards to Man of Nuclear and Allied Radiations", H.M. Stationery Office, London.

UNITED NATIONS SCIENTIFIC COMMITTEE ON THE EFFECTS OF ATOMIC RADIATION (1957), "The Responsibilities of the Medical Profession in the Use of X Rays and Other Ionizing Radiation", reprinted in *Australian J. Dermat.*, 4: 38.

SOME ASPECTS OF THE NEPHROTIC SYNDROME IN CHILDHOOD.[1]

By ROBERT VINES,

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FROM the multitude of studies of the nephrotic syndrome it can be seen that some small geographic differences are to be observed in its natural history. The variations have chiefly involved the age of onset, the possibility of an ætiological role for mercury, the types of infection associated with the onset and the prognosis. It was thought that a study of an Australian series might help to define more accurately the natural history as seen here, and perhaps throw some light on the condition by revealing further variations.

Definition.

For the purposes of the investigation, the nephrotic syndrome was defined as being marked by the presence of albuminuria and variable œdema together with hypercholesterolæmia or hypoalbuminæmia; but six cases were included in which massive albuminuria and œdema persisted with fluctuations for a number of weeks, but in which no estimations of cholesterol or protein levels in the blood were performed.

Material and Methods.

In all, 68 cases of the nephrotic syndrome were found in the records of the Royal Alexandra Hospital for Children out of approximately 360 admissions for all forms of nephritis between June 30, 1947, and June 30, 1954. Approximately one-third of these children were examined by me, but the resident medical officers of the hospital were responsible for the records of the remainder. Since their discharge the progress of these children has been followed by consulting records of their out-patient attendances, by reports from their private physicians and by means of a survey carried out in these last three months. For the purposes of the survey all patients were sent a *questionnaire* or were visited in their homes. For all except four of those so traced a recent report of their physical status and the results of examination of the urine thus became available, and on 24 of these subjects microscopic examinations of the urine and estimations of blood urea and blood cholesterol levels were performed.

Results.

Age and Sex.

Figure I shows that this syndrome is largely an affection of early childhood. The youngest patient was eight months

[1] Read at a meeting of the Section of Pædiatrics, Australasian Medical Congress (B.M.A.), Tenth Session, Hobart, March 1 to 7, 1958.

old at the onset of the disorder, which occurred equally commonly in the two halves of the second year of life. This age of highest incidence is lower than that reported from the United States of America and from Cuba, but similar to that reported by Arneil from Great Britain. In this series 37 patients were males and 31 females.

Ætiology.

This age incidence suggests that a single disease process may be responsible for producing most examples of the condition in infancy, whereas in later life a wide variety of causes of the syndrome can be recognized.

In this series one girl who later died developed the disorder while taking troxidone (*vide* Appendix, Case I). Another child (*vide* Appendix, Case II) developed the condition after a bee sting; this child's brother had also suffered from the nephrotic syndrome after a bee sting. No others with a family history of the complaint were encountered.

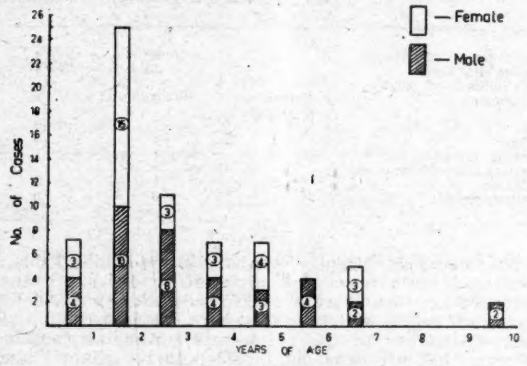

FIGURE I.
Age at onset in 68 children with the nephrotic syndrome.

Two cases had their onset within three weeks of the children being bitten by ticks, and one three days after the ingestion of a metal polish. It does not appear possible to assess the significance of these occurrences.

In one child (*vide* Appendix, Case III) an initial illness having a number of the features of acute glomerulonephritis (Ellis type I) was followed by the development of hypercholesterolæmia, which brought his illness within the scope of the definition of the nephrotic syndrome made above.

In 38 of the 58 children for whom a history of the initial episode of the disease was recorded, an infection had preceded the onset by less than a month. In two diarrhœa was the symptom attributed to infection, but in the others the infection had been a respiratory one. Ellis made an important point of the insidious onset and the lack of a history of preceding infection in the cases which he termed type II nephritis, and which consisted largely of cases of the nephrotic syndrome. In this series the day of onset was often well defined, and a history of preceding infection was nearly as common as Ellis found in his type I nephritis.

Largely because of Wilson, Thomson and Holzel's paper, an attempt was made to determine whether mercury was important in the ætiology of the nephrotic syndrome. The urinary mercury estimations were performed by F. R. Barrett, using a method developed by himself. Of 24 children with the nephrotic syndrome examined by this method, 11 had mercury in their urine (Table I). Not all of these children were included in this present series, as some were admitted to hospital after June 30, 1954; but at least two years have elapsed since the onset in all. Of 21 random hospital patients suffering from neither nephritis nor pink disease, nine had mercury in their urine. These figures do not suggest that mercury is an ætiological agent. However, of the 11 with the nephrotic syndrome whose urine contained mercury, none are known to have died and one is untraced (Table II). Of the other 60 patients in this present series, 19 are known to have died and 15 are untraced. If we assume independence of mortality rates and the presence or absence of mercury in the urine of traced patients, the expected number of deaths in the group with mercury in the urine is three. The findings differ significantly from this expectation. The ages of the patients with mercury in the urine were similarly disposed compared with the entire series, and the pattern of their illness did not differ significantly as far as the incidence

TABLE I.

Subjects.	Number with Mercury in Urine.	Number without Mercury in Urine.
Children with nephrotic syndrome	11	13
Controls	9	12

of a history of preceding infection or the presence of hypertension, azotæmia or hæmaturia was concerned. Three of those with mercury in their urine have slight albuminuria as a sole persisting abnormality. It is, then, an advantage to be excreting mercury when the nephrotic syndrome develops. As it seems highly unlikely that mercury administration constitutes good treatment, the alternative conclusion, that mercury causes a benign form of the disorder, appears probable.

TABLE II.

Children with the Nephrotic Syndrome.	Outcome.		
	Dead.	Alive.	Untraced.
Mercury in urine (11) ..	0	10	1
No mercury in urine or not tested (60) ..	19	26	15

Clinical Course.

A compilation (Table III) of the signs present when the children were admitted to hospital in an initial episode is of interest. In this series, all had both œdema and albuminuria; but elsewhere it has been observed that this is not necessarily the case, either sign occasionally being absent. While macroscopically evident hæmaturia was noted by the parents of only two patients, microscopically evident hæmaturia was observed on the admission to hospital of almost half the children. Gross hæmaturia is uncommon in the nephrotic syndrome as compared with acute glomerulonephritis, but it is apparent that this sign is not a reliable means of differentiating the two conditions.

TABLE III.
Signs Commonly Present on Admission to Hospital in Initial Episode.

Signs.	Outcome.		
	Dead. (12 Patients.)	Alive. (27 Patients.)	Untraced. (13 Patients.)
Albuminuria	All	All	All
Œdema	All	All	All
Microscopically evident hæmaturia	5	10	10
Oliguria	6	11	3
Ascites	11	5	1
"Cold"	6	7	2
Cough	5	6	2
Irritability	4	6	1
Vomiting	3	6	1
Rales	2	3	2
Anorexia	3	2	1

A series of resident medical officers was responsible for recording an unequivocal diagnosis of ascites in 11 of the

12 children examined in their initial episode who died, but in only five of the 27 who are known to have survived. These figures reveal a highly significant statistical difference, and suggest that the presence of ascites in the initial episode at the time of admission to hospital has considerable prognostic significance. Ascites developed later in a number of the children who had a favourable outcome. It has sometimes been suggested that the severity of the œdema is some guide to prognosis, and it may be that the ready detection of ascites early in the illness is a good objective indication of the rapid development of severe œdema. Usually œdema was first observed in the face.

The high incidence of respiratory signs has been noted. Drowsiness may be a sign of importance, as it was present on admission to hospital in two patients who died and in one who is untraced, but in none known to survive.

Hypertension, azotæmia and hæmaturia have all been considered to have some serious prognostic import, more particularly when they persist. Their incidence in this present series is shown in Table IV. No significant relationship between the presence of hypertension and hæmaturia and the outcome of the condition is apparent. However, even with the exclusion of one child in whom azotæmia was noted only shortly before death, there is a statistically significant relationship between its presence and a fatal outcome.

TABLE IV.

Incidence of "Nephritic" Signs in 68 Children.

Signs.	Outcome.			Total.
	Dead.	Alive.	Untraced.	
Hypertension (blood pressure 130/90 millimetres of mercury or higher) ..	5	5	6	16
Azotæmia (blood urea level over 40 milligrammes per 100 millilitres)	13	7	7	27
Hæmaturia (three or more red cells per high-power field in centrifuged deposit)	14	19	12	45

Leucocytosis was noted in 52 out of 58 cases, neutrophilia in 33 out of 54 and eosinophilia in 25 out of 50. Both leucocytosis and neutrophilia were frequently observed in the absence of any obvious infection. Eosinophilia tended to develop later in the course of the illness. The frequency with which these leucocyte changes may be present does not appear to be widely recognized.

Even such important signs of the syndrome as hypoalbuminæmia and hypercholesterolæmia were sometimes absent when they might have been expected to be present. One child had a total serum protein level of 6·7 grammes per 100 millilitres, including 4·2 grammes per 100 millilitres of albumin, when admitted to hospital with generalized œdema. Within two weeks the total serum protein content was 4·75 grammes per 100 millilitres.

Hypercholesterolæmia was found at some time in all except one case in which the estimation was performed; but normal levels were noted in one œdematous child several weeks after the onset of the condition, and in several children shortly after the loss of œdema, even when relapses occurred later. There was a tendency towards a continued increase in the height of the blood cholesterol levels throughout the course of the illness, and there was no consistent correlation between the degree of elevation of the serum cholesterol level and the degree of depression of the albumin level. In none of the 24 cases in which serum cholesterol estimations were carried out in these last two months was a raised level found.

Complications.

The development of anæmia has been held to be a feature of acute glomerulonephritis (Ellis type I); but it is apparent (Table V) that it is not uncommon in the nephrotic syndrome. In some studies the development of anæmia has been associated with a poor prognosis, but the figures here do not quite reach a level of statistical significance. Diarrhœa is a frequent complication of the syndrome. It seems questionable whether it is always infective in origin, though the remarkable facility with which affected children contract infections was well borne out in this series.

The appearance of "cellulitis" or an "erysipeloid" eruption on the flanks or thighs is usually associated with fever, vomiting, diarrhœa and some abdominal tenderness. Death from peritonitis ensued in five of the seven such episodes recorded.

TABLE V.

Some Complications During the Course of the Illness.

Complications.	Outcome.		
	Dead. (19 Patients.)	Alive. (32 Patients.)	Untraced. (17 Patients.)
Development of anæmia ..	6	2	4
Severe diarrhœa	4	4	2
"Cellulitis" of thighs or abdomen	6 times in 5 patients	0	1
Fits	2	1	0
Coma	1	1	0
Urinary infection ..	0	1	1
Strangulation of umbilical hernia	0	1	0
Intussusception	1	0	0

The nervous system disturbances noted in Table V probably result from electrolyte disturbances. Strangulation of umbilical herniæ seems to be almost confined to this syndrome, in which it is not rare. Intussusception also occurred in one of the children whose urine contained mercury, but who was not included in the general study series. Abdominal pain and vomiting are common symptoms in these children, and it is disturbing to realize that the diagnosis of intussusception, even if kept in mind, may be difficult to make because of the presence of ascites.

More than three episodes of œdema were not often observed in this series. The longest interval observed between relapses was three years (Appendix, Case I). It has not been at all uncommon for albuminuria and indeed hæmaturia, hypoproteinæmia and hypercholesterolæmia to be absent between episodes of the condition. Similar observations have been made by others, so that Homer Smith's statement that "a second episode, once recovery is effected, is not authenticated" becomes difficult to understand.

Treatment.

Antibiotics were used in treatment throughout the period of study. In the last three years of this period cortisone or corticotrophin were used, usually in low dosage and in short courses. Of those given these agents, five died and five lived. Measles affected five of these 68 children while in hospital, but in only one did the ensuing diuresis lead to anything more than a transient loss of œdema.

Mortality.

Estimates of the mortality rate of the nephrotic syndrome range from 15%, as suggested by Heymann and Startzmann, to more than 95%, as reported by Ellis. A figure in the region of 50% has been most often quoted. It is apparent that a death rate per year or some similar device for linking mortality and time is more applicable to this disorder than the bald stating of a mortality rate. Riley has even suggested that "healed" patients have a reduced life expectancy. Table VI suggests that at least half of the children studied will recover completely.

Table VII gives the impression that a more lavish use of antibiotics might further improve the prognosis in this condition. The frequency with which these children develop serious electrolyte disorders emphasizes the need for caution when giving fluids intravenously. The mercury poisoning noted resulted from the use of a mercurial

diuretic in the treatment of the nephrotic syndrome. It has become apparent that there is no place for the use of such drugs in this disease.

Ten of the deaths occurred in the first year after the onset of the disease, seven in the second, and one each in the third and fourth years.

In all of the 12 cases in which autopsy was performed, renal changes considered typical of the nephrotic syndrome were found. The kidneys were large and usually pale and there was at least some hyaline thickening of the basement membrane or increase in glomerular lobulation in all. Hyalinization and sclerosis of glomeruli was prominent in only one, in which the interval between the onset of the disorder and death was 17 months.

TABLE VI.

Outcome of the Nephrotic Syndrome in Children Three to Fourteen Years after Onset.

Patient's Condition.	Number of Patients.
Well, no albuminuria	24
Well, albuminuria	4
Reported well, results of urine examinations not available	4
Untraced	17
Dead	19
Total	68

Comment.

The nephrotic syndrome may certainly be caused by a number of widely different and well defined pathological processes, but disagreement exists as to the cause of the great majority of cases. Workers such as Addis hold that there are two distinct diseases, a pure or lipoid nephrosis and a second group in which the nephrotic syndrome is manifested as a phase in the evolution of chronic nephritis. Others hold that all cases represent a stage of chronic nephritis. The third view, that the disease is an entity, not preceded by acute nephritis, has been supported by many recent writers.

TABLE VII.

Conditions Leading to Death.

Condition.		Number of Cases.
Infections:		
Peritonitis	5	
Pneumonia	1	9
Meningitis	1	
Undefined	2	
Collapse after blood transfusion		2
Possible electrolyte disturbance:		
Convulsion and coma	1	5
Sudden collapse	4	
Mercury poisoning		1
Unknown		2
Total		19

It is thought that this present series offers no evidence to refute this last view and much to support it. How common in the nephrotic syndrome may be infection preceding the onset, hæmaturia and facial œdema is well seen in the group of children discussed. Each of these points tends to diminish the number of diagnostic differences which Ellis described as differentiating the nephrotic syndrome from acute glomerulonephritis.

Davson and Platt, Enticknap and Joiner and Clark have reported cases which they consider provide exceptions to the concept that the nephrotic syndrome is an entity clinically distinguishable from acute nephritis. I believe that if less trust is placed in a story of preceding infection, in hæmaturia or in facial œdema as diagnostic features, the cases quoted by these authors cease to be convincing exceptions. Certainly differentiation on the basis of the history and physical examination may not be possible; but if to the information so gained is added that obtained from estimations of serum protein and cholesterol levels, no convincing exception to the possibility of differentiating the two conditions appears to have been reported.

In this present series cases have been cited in which hypoalbuminæmia or hypercholesterolæmia was absent during an active phase of the disease. It is apparent, then, that neither can really be regarded as a fundamental feature of the disease process, and that indeed we cannot yet point to any particular sign as invariably present evidence that this disease process is occurring. Support for the idea that there is such a disease process at work to cause the nephrotic syndrome has recently appeared in Farquhar, Vernier and Good's description of a characteristic electron microscope picture in this condition.

Summary.

1. The histories of 68 children with the nephrotic syndrome admitted to the Royal Alexandra Hospital for Children between 1947 and 1954 have been examined, and the results of their analysis, together with the results of a follow-up study of the survivors, are reported.

2. A majority of the children were aged under three years at the onset of the disorder, the highest incidence being in the second year of life.

3. In one child the disease developed after a bee sting and in another while troxidone was being taken.

4. Eleven children found to have mercury in their urine had a significantly better prognosis than the remainder of the group studied; this suggests an ætiological role for mercury.

5. In a majority of the children an infection closely preceded the onset of the condition.

6. Leucocytosis and neutrophilia were found in the majority, eosinophilia in about half the patients.

7. A statistically significant association was shown to exist between the presence of ascites on admission to hospital in the initial episode and a fatal outcome, and between azotæmia and a fatal outcome.

8. Approximately half the children appear to have recovered completely, for although 19 have died, 32 are still alive, and of these only four are known to have albuminuria. Seventeen remain untraced.

9. It is considered that no evidence was obtained to refute the concept that the nephrotic syndrome is usually due to a single distinct disease entity not preceded by acute glomerulonephritis.

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References.

ADDIS, T. (1948), "Glomerular Nephritis: Diagnosis and Treatment", Macmillan, New York.

ARNEIL, G. C. (1956), "Proceedings of the Eighth Annual Conference on the Nephrotic Syndrome", edited by J. Metcoff: 123.

BARRETT, F. R. (1955), "Determination of Mercury in Urine with Results in Cases of Pink Disease", M. J. AUSTRALIA, 2: 411.

CLARK, N. S. (1956), "Nephritis in Childhood", *Arch. Dis. Childhood*, 31: 12.

DAVSON, J., and PLATT, R. (1949), "A Clinical and Pathological Study of Renal Disease", *Quart. J. Med.*, 18: 149.

ELLIS, A. (1942), "Natural History of Bright's Disease", *Lancet*, 1: 1, 34 and 72.

ENTICKNAP, J. B., and JOINER, C. L. (1953), "Bright's Disease: An Attempt at a Statistical Assessment of the Classification Proposed by Ellis", *Brit. M. J.*, 1: 1016.

FARQUHAR, M. G., VERNIER, R. L., and GOOD, R. A. (1957), "An Electron Microscope Study of the Glomerulus in Nephrosis, Glomerulonephritis and Lupus Erythematosus", *J. Exper. Med.*, 106: 649.

HEYMAN, W., and STARTZMANN, V. (1946), "Lipemic Nephrosis", *J. Pediat.*, 28: 117.

RILEY, C. (1955), "Proceedings of the Seventh Annual Conference on the Nephrotic Syndrome", edited by J. Metcoff: 199.

SMITH, H. W. (1951), "The Kidney", Oxford University Press, New York: 856.

WILSON, V. K., THOMSON, M. L., and HOLZEL, A. (1952), "Mercury Nephrosis in Small Children", *Brit. M. J.*, 1: 358.

Appendix.

CASE I.—A girl, aged six years, was admitted to hospital under the care of Professor L. Dods on August 24, 1953. She had suffered episodes of *petit mal* and *grand mal* since January, 1952. For this she had been treated with troxidone, phenytoin and phenobarbital for 18 months, with complete suppression of fits in the last eight months. On August 12, 1953, she had developed nasal discharge, cough and fever; she had been drowsy on August 18, and had fits on August 19, 20 and 21. Marked œdema was present from August 20, and ascites was noted and paracentesis performed prior to her admission to hospital on August 24. After admission her general condition improved for a time, though a number of fits occurred; but by September 11 ascites was again marked, and she had an alarming episode of tachypnœa with crepitations and rhonchi over both lung fields. After this episode she lost her œdema and albuminuria entirely.

No hypertension was noted during the course of the illness, nor was hæmaturia observed on repeated microscopic examination of the urine. A Mantoux test (1/1000 strength) gave a negative result, and X-ray examination of her chest revealed only a small opaque area in the region of the right lesser fissure, thought to be due to the presence of pleural thickening or encysted fluid. No mercury was present in her urine. On August 26 the hæmoglobin value was 14·1 grammes per 100 millilitres, and the leucocytes numbered 14,400 per cubic millimetre, of which neutrophils made up 8064, lymphocytes 3744, monocytes 440 and eosinophils 152. An electroencephalogram on September 25 revealed "bilateral slow wave and spike activity suggesting secondary epilepsy".

The mother by adoption of this child reported that she had died of renal disease in 1955.

CASE II.—A boy, in recent years a patient of Dr. C. W. G. Lee, first became œdematous a few hours after being stung by a bee when 16 months old. The œdema persisted. He was found to have albuminuria and was admitted to hospital. In 1935 an older brother had died, at the age of two years, of diphtheria contracted during a remission of the nephrotic syndrome. This brother's disease had also developed after a bee sting. Two older brothers are well, but a younger sister has been diabetic from the age of 16 months.

After his initial hospital admission in 1944, the patient developed ascites within a fortnight. His urine contained much albumin, and though red cells were initially absent, within six weeks a few were present, and these soon became numerous in the centrifuged urinary deposits. A single blood pressure reading of 90/60 millimetres of mercury was recorded on his admission to hospital. A serum cholesterol level of 351 milligrammes per 100 millilitres and a blood urea level of 76 milligrammes per 100 millilitres were found during this period. Three months after his admission to hospital decapsulation of the kidneys was performed; after this œdema and albuminuria disappeared within two weeks, and the serum cholesterol level was 221 milligrammes per 100 millilitres prior to his discharge from hospital five months after his admission.

An episode of albuminuria and slight œdema occurred in 1945. On this occasion the blood urea level was 17 milligrammes per 100 millilitres. Tonsillectomy was performed.

In a further relapse following a "cold" in 1946, ascites recurred, slight hæmaturia was evident microscopically, and his highest serum cholesterol level, 596 milligrammes per 100 millilitres, was reached. Treatment this time included the exhibition of thyroid extract and mercurial diuretics, and paracentesis abdominis. Within two months remission was complete.

No further episodes occurred until 1950, when a severe relapse with ascites followed the development of a "cold". As before, the patient had no hypertension, but his blood urea content ranged between 46 and 68 milligrammes per 100 millilitres, and a serum protein level of 3·0 grammes per 100 millilitres (of which only 0·8 gramme was albumin) was found. He was given mercurial diuretics and two blood transfusions and had a paracentesis abdominis. The œdema disappeared, but this time he still had albuminuria when discharged from hospital three months after the relapse began.

His mother had for some years made a practice of frequently testing his urine for albumin. She found that albuminuria ceased later in 1950 and did not recur until after a "cold" in 1953. Œdema was only transient on this occasion.

His sixth episode of albuminuria and œdema followed a "cold" contracted in 1955. A remission occurred after a course of corticotrophin, but there was a further relapse which cleared only after he had received cortisone, corticotrophin and a blood transfusion. Albuminuria was still present on his discharge from hospital, and continuous maintenance treatment with cortisone was given, despite which a further bout of œdema happened later in the year. Two episodes of œdema in 1956 occurred after "colds", and both times prednisolone was given. This treatment has been continued since then in a dosage of 15 milligrammes per day on three consecutive days each week. Though albuminuria has recurred after "colds", he has had no œdema, is well and has normal blood pressure, a normal blood urea content, a normal serum cholesterol level and a normal serum protein electrophoretic pattern.

CASE III.—A boy, aged five years, was admitted to hospital on September 1, 1947, under the care of Professor L. Dods. He had been referred because of the persistent presence of macroscopically evident hæmaturia and fever, which had developed shortly after the occurrence of acute tonsillitis a month before. Tonsillar injection, hypertension of the order of 120/75 to 155/100 millimetres of mercury and slight facial œdema were noted. Much albumin and numerous red cells were detected in the urine until February 9, 1948, when a heavy cloud of albumin persisted, but only two or three red cells per high-power field were observed in a centrifuged urinary deposit.

The patient developed a short-lived anæmia, the hæmoglobin level falling from 11·5 grammes per 100 millilitres on September 9 to 9·5 grammes on November 18, and then rising to 11·5 grammes again on December 13. The leucocytes numbered 8700 per cubic millimetre on November 18, and of these 7221 were neutrophils. The highest blood urea level recorded was 47 milligrammes per 100 millilitres on September 13, and on October 22 it was 40 milligrammes and thereafter lower still. On September 18 a blood cholesterol level of 405 milligrammes per 100 millilitres was noted. Treatment consisted of the giving of a course of penicillin and the administration of ferrous sulphate.

This boy has not been traced since his discharge from hospital in February, 1948.

ASPECTS OF CHRONIC GASTRITIS.[1]

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BROUSSAIS, the flamboyant and celebrated surgeon to the army of Napoleon, was one of the pioneer investigators of gastritis. However, when it was realized that his descriptions of the changes in the gastric mucosa were those of post-mortem autolysis, a wave of disbelief in the existence of this condition did not begin to subside until the classical studies of Faber and his co-workers at the beginning of this century.

By introducing formalin into the stomach almost immediately *post mortem*, they were able to obtain fixation of their specimens, and to provide accurate data on the structural changes and incidence of chronic gastritis. While this technique makes possible examination of large areas of gastric mucosa, the development of the flexible gastric biopsy tube (Wood *et alii*, 1949) has permitted accurate microscopic study of the gastric mucosa

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and correlation with clinical and biochemical observations, sometimes in the same patient over a period of time. Now, ten years after the development of this gastric biopsy technique, it is of interest to summarize our current knowledge of chronic gastritis.

Sampling Error.

This technique, by means of which a button of mucosa approximately two millimetres in diameter is obtained from the body of the stomach, is open to the criticism of sampling error. However, Hebbel (1949) showed that when chronic gastritis was present in the body of the stomach, it usually involved that area diffusely, while chronic inflammatory changes along the lesser curvature and in the antrum tended to be localized.

As a routine procedure, two biopsy specimens are taken at different levels from the body of the stomach, and of 726 cases, in 73·8% the appearances in the two sections were similar, while in 26·2% the differences in the sections suggested that the changes were patchy. Similarly, of 123 cases in which serial gastric biopsies were carried out, substantial agreement in histological appearances were present in 76·4% while in 23·6% it was not. In some of the latter the differences were due to the presence of ulcer and of carcinoma, and in others they may have been related to the changing course of the illness (Joske *et alii*, 1955). Further evidence in support of the general accuracy of the histological diagnosis has been the parallel change in the test meal results (*vide infra*).

Pathology.

A relationship to the clinical features of gastritis is probably best achieved by classifying the histological appearances into three broad groups, according to the activity of the inflammatory process and the degree of damage to the tubular glands which secrete acid and pepsinogen.

In superficial gastritis the mucosa is of normal width, and contains the normal complement of glands. There is evidence of damage to superficial epithelium with local infiltration of inflammatory cells. This lesion is probably capable of complete resolution, but with recurrences may progress to atrophic gastritis. Here there is slight, moderate or severe and irreversible atrophy of the glands, often coupled with a reduction in the width of the mucosa. Some subsidence of inflammation may occur, and with recurrent and progressive development of atrophy the mucosa may resemble that seen in non-inflammatory gastric atrophy.

Often no abnormality is detected macroscopically in chronic gastritis. In acute exacerbations erosions may be seen, and patchy areas of adherent mucus are commonly prominent. In severe atrophy the mucosa is reduced in thickness, and a coarse granular or mammillary surface pattern may be present. It must be emphasized that rugosity has no relationship to inflammatory change. The rugosity depends on the degree of contraction of the stomach and the action of the muscularis mucosæ. Apparent increase in rugosity should not be construed as hypertrophic gastritis, a condition we have never encountered. On the other hand, the so-called diffuse giant hypertrophic gastritis is an extremely rare condition, and shows some features which are more closely related to neoplasia than to inflammation.

The microscopic features of chronic gastritis were admirably described by Motteram (1951). They include epithelial cell damage and regeneration, cellular infiltration and increase in interstitial tissue. In the acute phases necrotic and desquamating cells are found in the pits and the superficial mucosa; however, the rate of desquamation must be greater than the rate of regeneration for frank erosions to occur. Epithelial regeneration is seen occurring particularly in the bases of the gastric pits, with stratification of cells, large hyperchromatic nuclei and a poorly differentiated scanty cytoplasm. The surface becomes covered by an irregular and flattened epithelium in which the mucigenic thecæ are poorly developed or absent.

Extension of the regenerative processes into the glands results in the replacement of the parietal and chief cells by non-specific or mucus-secreting cells. The pits and glands become distorted, elongated and coiled and pseudo-pyloric in type. Obstruction to the glands and inflammation cause cystic changes in the glands. Metaplasia to a true intestinal epithelium is common in gastritis associated with severe inflammation and atrophy. Such metaplasia shows changes to the dark intestinal columnar cell without a mucigenic theca, interspersed with mucus-secreting goblet cells. At the bases of the glands, Paneth cells and argentaffin cells are found. The areas of metaplasia are sharply demarcated and often focal in distribution.

Polymorphonuclear cells are usually present in the interstitial tissue and penetrating the epithelium and adjacent mucosa. Plasma cells are superficially present in large numbers, while lymphocytes diffusely infiltrate the deeper portions of the mucosa, often forming lymphoid aggregates in the base of the mucosa. The reticulum of the lamina propria is increased in amount, and may contain fat, congested vessels or red-cell extravasates. The muscularis mucosæ is thickened and splintered by the inflammatory cells and connective tissue.

Clinical Features.

Doig and Wood (1952*a*) have found that the symptoms of gastritis characteristically develop in the fifth decade, more commonly in females, especially if chronic alcoholics are excluded from the series. Flatulence and diffuse epigastric discomfort shortly after meals are often relieved by alkaline powders. Psychic stress frequently exacerbates the symptoms, which tend to recur periodically at short intervals. Varying degrees of diffuse epigastric tenderness are found on physical examination. There may also be evidence of anæmia, or of malnutrition—for example, loss of weight, atrophic glossitis and angular stomatitis. Mild hæmatemeses may occur, but usually bleeding is manifested by occult blood in the stools.

It is true that the majority of cases of chronic gastritis are symptomless. Joske *et alii* (1955) divided 1000 patients submitted to gastric biopsy into four groups and correlated these with the histological findings. Some of these data are set out in Table I. From this table it can be seen that symptoms attributable to gastritis alone or in part were present in 32% of patients with gastritis. They were also present in 6% of subjects with a normal mucosa, this latter figure indicating the relatively small diagnostic inaccuracy of the biopsy technique.

TABLE I.
Correlation between Histological Findings in Gastric Mucosa and Symptoms in 1000 Cases of Gastritis.

Symptoms.	Histological Findings.		
	Normal Gastric Mucosa. (167 Biopsies.)	Chronic Gastritis. (777 Biopsies.)	Gastric Atrophy. (56 Biopsies.)
None	33·0%	33·2%	62·4%
Symptoms referable to gastritis alone	1·2%	19·4%	19·6%
Symptoms referable to gastritis in part	4·8% (6·0%)	12·6% (32·0%)	9·0% (28·6%)
Symptoms referable to diseases other than gastritis	61·0%	34·8%	9·0%

While such a large percentage of patients with gastritis are apparently symptomless, this does not exclude gastritis as a cause of clinical symptoms any more than the not unusual occurrence of a painless peptic ulcer or cholelithiasis excludes these conditions as a cause of pain.

Wolf and Wolff (1943) have shown that in gastritis there is a considerable reduction in the threshold of pain to various noxious stimuli applied to the gastric mucosa, so that the pain and tenderness are probably directly

related to inflammation. There is no abnormality of gastric motility.

The Gastric Juice in Chronic Gastritis.

In chronic gastritis the volume of the gastric secretion, and the concentration of acid and pepsin as assessed by gruel and histamine test meal examinations, are generally reduced parallel to the degree of glandular atrophy seen in the histological sections (Wood *et alii*, 1949*b*). By measuring the amount of reducing substances after hydrolysis of the mucus in the test meal aspirates, Weiden (1949) showed that with severe atrophy there was a considerable decrease in total mucus secretion, but because of the greater decrease in total secretion, the actual concentration of mucus was greater. The decreased formation of mucus by damaged and regenerating immature epithelium is evident on histological examination, and the mucus secreted by pseudo-pyloric glands and goblet cells may be different in quality from that normally secreted by gastric epithelium. These facts may account for the apparent prominence of mucus on the mucosa and in the gastric secretions in chronic gastritis.

The Incidence and Causes of Chronic Gastritis and its Relationship to Peptic Ulcer, Carcinoma of the Stomach and Anæmia.

The increasing incidence of gastritis with age must be partly due to the development of irreversible changes following repeated exacerbations over a period of time. There may be some effects due to vascular disease.

In our experience chronic alcoholism is frequently associated with chronic gastritis. Doig and Wood (1952*a*) found that in 19 of 112 cases of histologically proven gastritis the patients were chronic alcoholics, while Joske *et alii* (1955) reported that of 95 biopsies on chronic alcoholic subjects, 50 showed evidence of chronic gastritis. Using gastroscopic and gastric biopsy examinations, Palmer (1954) demonstrated acute gastritis in 30 out of 36 young males within several hours of an acute alcoholic bout, but in nine of 11 patients submitted to a second biopsy seven to 20 days later the findings had returned to normal, and he considered that alcoholism rarely caused chronic gastritis.

Fairley *et alii* (1955) were unable to find a clear relationship between chronic gastritis and malnutrition. Nevertheless, the high incidence of malnutrition amongst Australian housewives (Epstein *et alii*, 1950) and the preponderance of females with chronic gastritis may indicate a relationship.

Psychic stress causes congestion of the gastric mucosa, and when this is severe and sustained erosions and bleeding occur (Wolf and Wolff, 1943). The ingestion of beverages such as tea has been related to gastritis (Edwards and Edwards, 1956), but it may be that these patients achieve relief of their symptoms in this way.

Chronic gastritis is frequently found in patients with debilitating diseases such as chronic renal failure, ulcerative colitis, rheumatoid arthritis, chronic infections and malignant diseases. Chronic gastritis is a feature of Sjøgren's disease, in which there are also atrophy and inflammation of the lachrymal and salivary glands. Mild inflammatory changes are sometimes found in the stomach in hæmochromatosis, when iron pigment is deposited in the glands.

Chronic gastritis can also be induced by therapeutic X-ray irradiation of the stomach for duodenal ulcer (Brown and Wood, 1955), and may also develop in the gastric remnant after partial gastrectomy. Patients with radiation gastritis suffer little or no discomfort, possibly because the nerve endings in the stomach wall have been rendered insensitive by the irradiation.

The average age of onset of symptoms of chronic gastritis and gastric ulcer is similar. Localized gastritis with superficial erosions may predispose the patient to further ulceration, owing to the peptic action of the gastric juice secreted by the remainder of the mucosa. There is usually zonal gastritis surrounding the ulcer. In patients with duodenal ulcer, the mucosa of the body of the stomach either is normal or shows some superficial gastritis (Doig and Wood, 1952*b*), while Magnus (1952) found mild to moderately severe antral gastritis in such patients. It is improbable that duodenal ulceration would occur in the presence of extensive gastritis with achlorhydria.

Carcinoma of the stomach is usually accompanied by hypochlorhydria, often achlorhydria. Random biopsies have shown gastritis in 16 of 20 cases of carcinoma of the stomach (Joske *et alii*, 1955). However, Fairley *et alii* (1955), following a small series of 32 patients with severe chronic gastritis for five years or more, found no evidence of the development of carcinoma. It seems probable that there is extensive zonal gastritis secondary to the tumour. Nevertheless, Witts (1956) has stated that female patients with iron-deficiency anæmia and achlorhydria are prone to develop carcinoma of the mouth and hypopharynx, so that an open mind should be kept about the liability to carcinoma of the stomach.

Anæmia in chronic gastritis is usually of hypochromic microcytic type. Iron deficiency is due to low intake or gastric hæmorrhage (Doig and Wood, 1952*a*). Alternatively, Witts (1956) has suggested that gastritis and achlorhydria are the direct result of iron deficiency.

Occasionally pernicious anæmia due to vitamin B_{12} deficiency may develop, and Joske *et alii* (1955) found that chronic gastritis with severe atrophy was present in 60 of 100 cases of pernicious anæmia and/or subacute combined degeneration of the spinal cord.

Conclusion.

In conclusion, it is the opinion of our Unit that chronic gastritis is a disease entity with specific symptoms, signs and pathological features. The diagnosis requires exclusion of other conditions causing dyspepsia and/or anæmia. Treatment therefore includes reassurance regarding the absence of malignant disease or ulceration, attention to anæmia, symptomatic relief, adjustment of the diet and, last but not least, sympathetic handling of the patient.

References.

BROUSSAIS, F. J. V. (1831), "History of Chronic Phlegmasiæ or Inflammations", translated from the French of the fourth edition by Isaac Hays and R. Eglesfeld Griffith, Carey and Lear, Philadelphia.

BROWN, G., and WOOD, I. J. (1955), "Antroduodenectomy and X-Ray Irradiation in the Treatment of Duodenal Ulcer: A Progress Report", *Australian and New Zealand J. Surg.*, 24: 260.

DOIG, R. K., and WOOD, I. J. (1952*a*), "Gastritis: A Study of 112 Cases Diagnosed by Gastric Biopsy", M. J. AUSTRALIA, 1: 593.

DOIG, R. K., and WOOD, I. J. (1952*b*), "Gastric and Duodenal Ulcer: A Survey of 141 Cases", M. J. AUSTRALIA, 1: 602.

EDWARDS, F. C., and EDWARDS, J. H. (1956), "Tea Drinking and Gastritis", *Lancet*, 2: 543.

EPSTEIN, I. S., MACKAY, M. A., and TURNER, C. N. (1950), "Control of Malnutrition", M. J. AUSTRALIA, 1: 799.

FABER, K., and BLOCH, C. E. (1900), *"Über die pathologischer Veranderungen am Digestionstractus bei der perniciosen Anämie und über die sogenannte Dermatrophie", Ztschr. klin. Med.*, 40: 98.

FAIRLEY, K. F., TURNER, C. N., MACKAY, M. A., and JOSKE, R. A. (1955), "Atrophic Gastritis: A Five Year Survey of 32 Cases Proven by Gastric Biopsy", M. J. AUSTRALIA, 2: 1085.

HEBBEL, R. (1949), "The Topography of Chronic Gastritis in Otherwise Normal Stomachs", *Am. J. Path.*, 25: 125.

JOSKE, R. A., FINCKH, E. S., and WOOD, I. J. (1955), "Gastric Biopsy: A Study of 1,000 Consecutive Successful Gastric Biopsies", *Quart. J. Med.* (New Series), 24: 269.

MAGNUS, H. A. (1952), "Gastritis", in "Modern Trends in Gastroenterology", 1st edition, edited by F. Avery Jones, London: 323.

MOTTERAM, R. (1951), "A Biopsy Study of Chronic Gastritis and Gastric Atrophy", *J. Path. & Bact.*, 63: 389.

PALMER, E. D. (1954), "Gastritis—A Revaluation", *Medicine*, 33: 199.

WEIDEN, S. (1949), "Some Observations on the Secretion of the Stomach with Special Reference to Mucus", M. J. AUSTRALIA, 2: 61.

WITTS, L. J. (1956), "Anæmia and the Alimentary Tract: The Relationship Between Changes in the Alimentary Tract and Deficiencies of Iron, Folic Acid and Vitamin B_{12}", Royal College of Physicians of Edinburgh Publications, No. 7: 37.

WOLF, S., and WOLFF, H. G. (1943), "Human Gastric Function. An Experimental Study of a Man and his Stomach", Oxford University Press, London.

WOOD, I. J., DOIG, R. K., MOTTERAM, R., and HUGHES, A. (1949a), "Gastric Biopsy: Report on Fifty-five Biopsies Using a New Flexible Gastric Biopsy Tube", *Lancet*, 1: 18.

WOOD, I. J., DOIG, R. K., MOTTERAM, R., WEIDEN, S., and MOORE, A. (1949b), "The Relationship between the Secretions of the Gastric Mucosa and Its Morphology as Shown by Biopsy Specimens", *Gastroenterology*, 12: 949.

GASTROSCOPY—A REVIEW OF 1100 CASES.[1]

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THE modern era of gastroscopy began in 1932, with the introduction by Schindler of the flexible gastroscope. Yet, even today, this very useful procedure is not accepted by many physicians. It was this fact that prompted me to analyse these 1100 cases investigated by me at the Royal Melbourne Hospital between 1949 and 1957 (Table I). This analysis will be used to show in just what type of case most help can be given by gastroscopy.

INSTRUMENTS AND TECHNIQUE.

The standard instrument has been of the Hermon Taylor pattern. This has the great advantage of allowing a good inspection of the posterior wall, where a large percentage of ulcers are found. Unfortunately, it is not safe to use this instrument in females aged over 50 years, for fear of damage to the hypopharynx, so a more flexible (Schindler type) instrument is necessary for these patients.

The examination should be made only after X-ray examination with a barium bolus has shown that there is no obstructive lesion, except in emergencies, as will be mentioned later. It is best carried out early in the morning, after the patient has spent the preceding night in hospital; complete fasting for 12 hours and adequate sedation are necessary. Morphine and hyoscine are given 45 minutes before the examination is started, and the throat is anæsthetized by gargling two cubic centimetres of 2% amethocaine solution. This local anæsthetic is quite safe, provided care is taken with the dosage. The patient lies on the left side with the head supported by an assistant. A darkened room is all that is necessary, to avoid the awe engendered by an operating theatre.

INDICATIONS.

The indication for gastroscopic examination have been as follows.

Gastric Ulcers.

Chronic Ulcers.

A total of 272 chronic gastric ulcers was seen in this series. There are three main reasons for looking at a chronic ulcer.

1. The biggest worry is to decide whether an ulcer is malignant. The site may help, as ulcers on the greater curve are nearly always malignant. It is the ulcer on the lesser curve that presents a very real problem at times. The size of the ulcer on X-ray examination does not help. By observation of the following points, gastroscopy can often give the answer: (*a*) Raised, hard edges with irregularities are seen in carcinoma. (*b*) Often in malignant disease there is irregularity, rigidity or nodularity in the surrounding mucosa, but no sign of healing. (*c*) Elevation of the ulcer as a whole, of course, favours malignancy, but it is not often seen. (*d*) Unevenness of the base is often seen in carcinoma. Sometimes, the examination has to be repeated in two weeks to make sure. By this time, a simple ulcer will show some sign of healing.

2. The second reason is to assess healing. Healing of an ulcer can be assessed only by gastroscopy. Clinical features are not reliable, and X-ray examination is not so useful here. In any trial of therapy, gastroscopy is the only dependable procedure. It is well recognized that complete healing means a better prognosis for the patient. If there is only slight change in the size of the ulcer, despite adequate treatment, then surgery is clearly indicated.

3. The third reason is to avoid false diagnosis. Sometimes an ulcer is diagnosed on barium meal X-ray examination, and yet gastroscopy shows the lesion to be an irregularity in the mucosal folds holding up the barium. Gastric diverticula (only two have been seen) may be another source of error. In diverticula, the smooth opening of the sac is obvious to the gastroscopist.

TABLE I.
Lesions Found in 1100 Gastroscopies.

Lesion.	Number of Cases.
Acute gastric ulcer	44
Chronic gastric ulcer	272
Carcinoma	83
Reticulo-sarcoma	2
Gastritis	61
Stomal ulcers	5
"Post-operative stomachs" (positive findings only)	22
Polypi	6
Diverticulum	2
Total	497

Acute Ulcers.

Forty-four acute gastric ulcers were seen. These can be found only if gastroscopy is undertaken within a few days of hæmorrhage or of the onset of pain. They form a most important group, both in establishing the cause of hæmorrhage and also in deciding the question of prognosis and surgical intervention. Avery Jones and I (1953) have shown that females with an acute lesion do well without operation, but males may require gastrectomy. These ulcers form an often unrecognized cause of recurring dyspepsia.

Prepyloric Ulcers.

Prepyloric ulcers form a difficult group clinically, and are the most frequent cause of disagreement between radiologist and gastroscopist (Table II). Often, in a case of what appears to be prepyloric ulcer on radiological examination, a perfectly normal pyloric canal is found at gastroscopy—frequent indirect evidence of a duodenal ulcer, as mammillation of the mucosa and a large volume of secretion are seen in these cases.

TABLE II.
Gastroscopic Findings in Cases Diagnosed Radiologically as Prepyloric Ulcer.

Gastroscopic Finding.	Number of Cases.
Normal pyloric canal	56
Incomplete view	8
Simple ulcer	17
Carcinomatous ulcer	15
Mucosal thickening	11
Spasm only	6
Simple scarring	6
Extrinsic pressure	3
Total	122

If the radiologist has any doubts about the pyloric antrum, then a gastroscopic examination should be made. In middle age or over, any ulcer in this area must be viewed with suspicion. Often the ulcer is seen to show malignant characteristics. It must also be admitted that this is the region of technical difficulties, and it may not be possible to see the whole pyloric canal, particularly the lesser curve aspect.

[1] Read at a meeting of the Section of Medicine and Experimental Medicine, Australasian Medical Congress (B.M.A.), Tenth Session, Hobart, March 1 to 7, 1958.

Tumours.

Simple Tumours.

Simple tumours consist of polypi and leiomyomata. Only six polypi have been seen, and it may be possible, on the appearances of both the polypus and the surrounding mucosa, to decide whether it is simple or not. The only leiomyoma I thought I had seen turned out to be a chronic ulcer, with almost complete sealing-in of the crater and penetration as well, the appearance being that of a rounded swelling with ulceration. Sometimes, the appearance of a tumour may be given by extrinsic pressure indenting the barium-filled stomach. This has been seen to be due to splenic pressure, to an aneurysm of the splenic artery and, most often, to enlarged glands behind the stomach. By a careful look at the mucosa and the movement in the affected areas, extrinsic pressure can often be recognized.

Malignant Tumours.

Only 83 cases of carcinoma were encountered in this series. In most cases, the diagnosis is obvious on X-ray examination, and nothing can be gained by gastroscopy. Both Mr. Julian Smith and Mr. Grayton Brown, who do my surgical work at the Royal Melbourne Hospital, have found the added information as to the extent of the growth along the mucosa to be helpful. For this reason, gastroscopy has been carried out before operation.

It is in the doubtful cases that most help is obtained. Mention has already been made of the malignant ulcer. Shortening of the lesser curve is commonly ascribed to healing of the gastric ulcer; yet in five cases it was shown to be due to carcinoma, and resection was carried out. The prepyloric region is another area where gastroscopy often clears up a doubt raised by the radiologist. If the pyloric antrum can be readily distended, and if peristaltic waves are seen to pass evenly along it with normal-appearing mucosa, then spasm was the cause of the radiological appearance. Areas of rigidity or doubtful filling defects seen at X-ray examination should always be inspected through the gastroscope; by this combined attack, diagnostic accuracy can be improved by at least 10%. In younger people, involvement of the stomach by reticulosarcoma may be seen—two such cases occurred in this series.

The one type of carcinoma that may evade the gastroscopist is the early infiltrating lesion, in which there is no disturbance of the mucosal surface.

Hæmatemesis and Melæna.

In hæmatemesis and melæna, gastroscopy in properly selected cases may provide much useful information. It cannot be performed during active bleeding, but can be carried out easily immediately bleeding has ceased. When the patient was very ill, the examination has been performed by removing the head of the bed, without disturbing the patient. It is particularly useful when there is no history of ulcer dyspepsia and no previous barium meal X-ray examination, and the bleeding continues. During 1953-1954, gastroscopy was carried out on 55 such patients as a definite trial procedure; in no less than 28, acute or chronic ulcers were found. It is interesting to note that at least two patients had been regarded as having bleeding varices, because of a large liver and a large alcoholic intake; both had moderate-sized ulcers without any history of pain at all. It will be seen that a diagnosis was reached by this means in 49 of the 90 cases examined (Table III).

Post-operative and Stomal Ulcers.

Stomal ulcers are often difficult to see, as they may be situated in the jejunum behind the opening of the stoma. Only five were seen. More often, a good idea of the functioning of the stoma can be obtained by gastroscopy. A poorly functioning stoma shows œdema of the surrounding mucosa, even a watery ragged appearance, and peristalsis is irregular. A well-functioning stoma does not gape, but contracts rhythmically. In a later stage actual deformity may be seen. More than half the stomata examined did not show any lesion.

Occasionally, in the first few weeks after gastrectomy, bleeding may occur from the edge of the anastomosis, due to an acute erosion or to temporary œdema and swelling of the mucosa in this region. It is very reassuring for the surgeon if this is found.

Dyspepsia with Negative X-ray Findings.

Dyspepsia with negative X-ray findings is probably the most useful field for gastroscopy (Table IV). Two carcinomatous ulcers were found after a barium meal X-ray examination had been reported as giving negative results by skilled radiologists in each case. The flat subacute or the shallow chronic ulcer may not hold sufficient barium to be seen radiologically. Acute ulcers, of course, are not seen radiologically. With the exclusion of acute ulcers, 14 subacute or chronic ulcers were seen in patients with normal X-ray findings. (This could be checked only in 1953-1957, when 760 examinations were made.)

TABLE III.

Gastroscopic Findings in Cases of Hæmatemesis and Melæna, 1953 to 1957 (90 Examinations).

Lesions Found.	Number of Cases.
Acute ulcer	17
Chronic ulcer	18
Gastritis	6
Carcinoma	1
Duodenal ulcer (indirect evidence)	7
Total	49

Gastritis.

Gastroscopy has been rather disappointing in the field of gastritis. Schindler originally described many changes which he called gastritis; but the use of a focusing instrument and further experience have shown that a lot of these so-called changes are merely variants of the normal.

The changes that can be recognized gastroscopically are complete atrophy, gross degrees of chronic superficial gastritis and the hypersecreting mucosa of a duodenal ulcer (mammillation). Hypertrophic gastritis is a rare entity, and it is nearly always impossible to distinguish from malignant change. (Even the surgeon can experience difficulty with the stomach in his hands.) Antral gastritis has been a popular diagnosis in the past but, here again, it is often not possible to distinguish from malignant disease. If there is any doubt after X-ray examination and gastroscopy in this region, I prefer to resort to laparotomy.

TABLE IV.

Gastroscopic Findings in Cases of Dyspepsia with Negative Radiological Findings, 1953 to 1957 (760 Routine Gastroscopies).

Type of Ulcer.	Number of Cases.
Subacute and chronic ulcer	14
Carcinomatous ulcer	2
Total	16

Duodenal Ulcer.

The only occasions on which gastroscopy is useful in duodenal ulcer are as follows: (i) when spasm occurs in the pyloric antrum, so that the radiologist is suspicious; (ii) if there is any doubt about an associated gastric ulcer; (iii) when pyloric stenosis has supervened and a differentiation from carcinoma is necessary. At times, it is difficult to distinguish radiologically between prepyloric and duodenal ulcers; in these cases, gastroscopy can help.

Experimental Work.

Most of our knowledge of the natural history of acute gastric ulcers was obtained by gastroscopy. In any trial of therapy, healing can be best assessed by this means. In the early days of gastric biopsy at the Royal Melbourne Hospital, it was of the greatest help to be able to see the size and site of the biopsy puncture.

An attempt has been made to find the definitive uses of gastroscopy in a series of my own. There is no doubt that, properly used, it can be a most valuable diagnostic aid. It must never be used in preference to radiology, except in emergencies; but when it is combined with radiology, it makes for a very significant increase in diagnostic accuracy.

SUMMARY.

1. A series of 1100 gastroscopic examinations is analysed and presented.

2. The technique is briefly described.

3. The main indications for gastroscopy are: (*a*) to differentiate simple from malignant ulcers; (*b*) to diagnose acute gastric ulcers; (*c*) in the diagnosis of the cause of hæmatemesis; (*d*) in the elucidation of dyspepsia with negative X-ray findings; (*e*) in prepyloric lesions.

4. Other less important indications are: (*a*) carcinoma of the stomach; (*b*) investigation of the stomach after operation; (*c*) gastritis; (*d*) duodenal ulcer; (*e*) experimental work.

5. The use of gastroscopy in each of these sections is discussed, with particular reference to its diagnostic value and its limitations.

6. The use of combined radiology and gastroscopy increases diagnostic accuracy by at least 10%.

ACKNOWLEDGEMENTS.

My thanks are due to the medical staff of the Royal Melbourne Hospital for referring patients to me for gastroscopy, and especially to Dr. Ian Wood, who has always encouraged me in this work.

REFERENCES.

JONES, F. AVERY, and KING, W. E. (1953), "A Study of Acute Gastric Ulcers Causing Hæmorrhage", *Australasian Ann. Med.*, 2:179.

SCHINDLER, R. (1936), "Gastroscopy", Univ. Chicago Press.

PSORIASIS: A PHYSICIAN'S EVALUATION.[1]

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WHEN a disease is rare, no single observer during a short lifetime will have the opportunity of studying a sizeable quantity of clinical material. Pathological material will also be scanty, it being remembered, also, that all rare disease are not necessarily fatal. So it seems reasonable enough to take a philosophical view of the pathogenetic obscurity of a rare disease.

In the case of common diseases, the position is somewhat different. Specialists in a particular field can study in the clinic and at the bedside a particular symptom complex in huge numbers. Pathological material (biopsy, post-operative, post-mortem) is abundant; and yet there are common diseases the pathogenesis of which is elusive. The internist has nothing to boast about concerning his knowledge of the fundamentals of (say) peptic ulcer. Similarly, in the field of skin diseases, psoriasis is at once the bugbear, the *pons asinorum* and the shame of the dermatologist. It is all very vexing.

The Present Position.

A tremendous literature on the disorder has grown up, comparable with that of multiple sclerosis in neurology, or of the leukæmias in hæmatology. Pathogenesis and treatment excepted, practicaly everything is known about psoriasis. The climatic and meteorological factors in its ætiology are clear-cut. So is racial distribution. Its pathological histology is comparatively simple. The diagnosis is so straightforward that there is really no differential diagnosis. Slight variations in distribution of the lesion (face, penis, palms, soles) or in the character of the rash (guttate, nummular, discoid) may confuse the tiro, never the expert. Just as the little baby suffers, or does not suffer, from congenital pyloric stenosis, so the patient has, or does not have, psoriasis. In the untreated case, complications are unknown. When they do occur, they are invariably iatrogenic.

Throughout the patient's life, psoriasis retains its own peculiar characteristics. With few exceptions, the natural history of the disease is one of chronicity, and of a capricious and unpredictable tendency to relapse and remit. This sterotyped clinical course is the rule. *Formes frustes* are few and far between. Given the abnormal and unknown constitutional background, psoriasis, like murder, will out. To return for a moment to ætiology, the old literature appears to gloss over the heredity factor. On reading between the lines in more recent writings, it is apparent that the factor of heredity is now being stressed. May I remind you that studies in human genetics have provided much valuable information on certain diseases of the alimentary tract? It is now known that individuals with blood group O have an increased susceptibility to duodenal ulcers. So far as I am aware, no genotropic approach has yet been made in the modern study of psoriasis. By photoelectric methods, it has been shown that there is an alteration in the pattern of the peripheral circulation. This disturbance occurs in areas remote from the skin lesion. Whether this dysfunction is organic or functional is not known. These modern investigations do not throw much light on the pathogenesis of psoriasis, and they are certainly not specific, because the same thing occurs in lupus erythematosus, arteriosclerosis, hypertension and scleroderma. In recent times, there has been a great pother in trying to establish a relationship between psoriasis and other diseases. There is talk of ocular psoriasis. The hook-up of psoriasis and rheumatoid arthritis has been heavily underlined, and a new clinical entity has been launched under the title of psoriatic arthritis. Articles have been written about psoriasis and rheumatic fever, complete with misleading tables of comparison. It would be quite easy to draw up a list of points of contrast. That blessed word, allergy, has received dishonourable mention. Abnormal metabolic processes have been confidently postulated. Too much (or too little) protein, fat, carbohydrate in the diet—all three—have been blamed for the psoriatic eruption. All or any of the above-mentioned associations are fortuitous, coincidental or frankly mythical.

On the subject of metabolism, however, it is interesting to note that many years ago, in 1930, Von Kerckhoff demonstrated a diminution of melanin in the epidermis, and put forward the view that psoriasis was a deficiency disease—a deficiency of light. I do not know whether this theory has been followed up, or abandoned. But in view of much new knowledge of melanin and its metabolism, the matter may well bear reinvestigation. The relevant question seems to be whether psoriasis ever occurs in patients suffering from Addison's disease or in albinos. In the field of general medicine, it is now the fashion to speak of the epilepsies, the diabetides, the nephritides, the sarcoidoses and so on, implying thereby that these disease-patterns are the result of multifactorial morbid processes. There is some justification for this nomenclature. But, in our present state of knowledge of this disease, it would be faintly absurd to complicate the position by speaking of the psoriases.

Psychiatric Considerations.

In recent times, much has been written concerning the psychiatric background of psoriasis, and valiant attempts have been made to bring it into the group of the so-called "stress" diseases. It is true that bottled-up emotions, disappointments in love, marital incompatibility, financial worry and unsatisfactory adjustments to the life situation

[1] Read at a meeting of the Section of Dermatology, Australasian Medical Congress (B.M.A.), Tenth Session, Hobart, March 1 to 7, 1958.

in general can, not infrequently, precipitate a relapse. This is by no means unique to psoriasis. Such unfavourable psychological states exaggerate dozens of disease patterns. It is true, also, that various abnormal conditions—timidity, moodiness, compensatory aggressiveness, anti-social conduct, exhibitionism—are occasional psychiatric accompaniments of the disease.

Further, the dermatologist knows better than most the suspicious attitude of the layman towards psoriasis. "Is it due to dirtiness and neglect?" "Is it venereal?" "Is it catching?" "Why can't so-and-so go swimming or sunbake?" Fastidious dancing partners, parental fusspots, queasy-stomached barbers and bed-making chambermaids may be appalled at the nature of the eruption. Marital abhorrence frequently rears its ugly head. It is true that this suspicion does upset some psoriatics. But the majority of patients bear their affliction with fortitude and resignation. In other words, a characteristic of the disease, in the main, is a normal mentality.

Toying and flirting with the psychological make-up of the psoriatic and overstressing its significance are, in my view, unjustifiable and erroneous. This psychiatric red herring cannot but delay the ultimate solution of the riddle of pathogenesis.

Treatment.

The modern drug treatment of the disease has all the flavour and stink of a contemporary witch's cauldron. Listen to this list of substances—as far apart as the poles in their known action—that have been employed in the last few years: Vitamin B_{12} in colossal, unphysiological and wasteful dosage; the corticosteroids in minute, ineffectual or huge, literally hair-raising, quantities; heparin; "Atebrin"; folic aid; riboflavin and methionine. One bright American sportsman is accustomed to exhibit "Aminopterin", if you please—a dangerous cellular poison which the internist prescribes with fear and reluctance, and then only in incurable diseases.

A degree in medicine produces some curious effects on people. W. Shakespeare understood this very well (*Measure for Measure*, II, 2):

> —but man, proud man!
> Dress'd in a little brief authority,
> Most ignorant of what he's most assured,
> His glassy essence,—like an angry ape,
> Plays such fantastic tricks before high heaven
> As make the angels weep;

All round the world, conscientious professors of therapeutics should be shedding bitter tears, over this irrational shot-gun therapy.

The modern master of the disease (if, indeed, such an implacable relentless enemy as psoriasis can be said to have a master) is Ingram of Leeds, England.[1] He is, so to say, a kind of Chief Rabbi, presiding over an elaborate, almost religious, ritual. The Leeds School, quite rightly, refuses to admit the incurability of the disease. This attitude of mind is conveyed to the clientèle. The psychological effect of their strict standardized routine is, I imagine, equally as salutary and beneficial as the unguents they use. Leeds has a great reputation for the management of psoriasis, and everybody seems satisfied. I have yet to hear of the sacrificial lambs turning round to bite the High Priest or his acolytes.

In the grimy, sunless Midlands, it is obligatory to use artificial sunlight as an adjuvant. My old teacher, Molesworth père, maintained that the ersatz lamp was not a patch on the natural solar rays. May I ask members of the section, is that true or false? He also thought that it was legitimate to employ small doses of X rays to the face, to tide patients over important social occasions such as weddings, christenings and funerals. My colleague, Molesworth *fils*, informs me that patients occasionally trick him into giving repeat doses of this efficacious but potentially dangerous form of treatment.

Conclusion.

It is a curious fact, in this present golden age of medicine, that this malady, in essence so benign, in appearance so loathsome, has not shared in the notable advances in our knowledge of pathogenesis and treatment of disease generally. On the contrary, it has remained exasperatingly elusive.

I sometimes think that dermatology has "had" psoriasis. The writings concerning the association of the disorder with other diseases are not convincing, and some contain an element of hedging and shuffling—an attempt to "pass the buck" to general medicine. I find no evidence that psoriasis is anything but an ectodermal manifestation of some as yet undiscovered constitutional or hereditary factor.

It is idle to read into the disease any serious disturbance of *le milieu interne*, of Claude Bernard. The famous half-jibe, half-aphorism and wholly discomforting dictum of Hebra is true: psoriasis is a disease of the otherwise physically healthy. Mr. President, the ball is back in the dermatologists' court.

[1] Dr. Ingram is now at Newcastle-on-Tyne, where he occupies the first Chair of Dermatology to be established in England.

References.

ANNOTATION (1934), "A New View of Psoriasis", *Lancet*, 2:605.

BARBER, H. W. (1938), "The Skin Manifestations in Rheumatism", *Proc. Roy. Soc. Med.*, 31:701.

BARBER, H. W. (1946), "Psoriasis Unconquered", *Lancet*, 2:696.

BARBER, H. W. (1950), "Psoriasis", *Brit. M. J.*, 1:219.

BECKET, P. E. (1936), "Psoriasis: A Brief Historical Review", 33:327.

DEWAR, W. A. (1957), "Observations on Steroid Therapy in Psoriasis", *Brit. J. Dermat.*, 69: Number 2.

GANS, O. (1952), "Some Observations on the Pathogenesis of Psoriasis", *Arch. Dermat.*, 66:598.

GRAHAM, D. T. (1954), "Relation of Psoriasis to Attitude and to Vascular Reactions of the Human Skin", *J. Invest. Derm.*, 22:379.

INGRAM, J. T. (1938), "Some Problems in Psoriasis", *Brit. M. J.*, 1:881.

INGRAM, J. T. (1953), "The Approach to Psoriasis", *Brit. M. J.*, 2:591.

INGRAM, J. T. (1954), "The Significance and Management of Psoriasis", *Brit. M. J.*, 2:823.

KALDEC, R. (1953), "Ocular Psoriasis", *Arch. Dermat.*, 68:44.

LERNER, A. B. (1955), "Melanin Pigmentation", *Am. J. Med.*, 19:902.

VIANI, H. (1956), "A Survey of Psoriasis", *J. Irish M. A.*, 39:142.

WRIGHT, V. (1957), "Psoriasis and Arthritis", Brit. J. Dermat., 69:1.

DIET SHEETS FOR SPECIAL DIETS[1] FROM THE DEPARTMENT OF DIETETICS, ROYAL *NEWCASTLE HOSPITAL.*

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SOME therapeutic diets currently in use are unnecessarily complicated although simplicity should always be the goal in dietary treatment. A set of diet sheets of the most commonly prescribed diets has been prepared by the Dietetics Department of the Royal Newcastle Hospital. They are suitable for distribution to out-patients. They can also be used for in-patients in hospitals whose staff does not include dietary specialists. One of our aims in planning the diet sheets was simplification; but sufficient information is given to answer most of the queries from patients regarding the details of the diets.

In practice, diet therapy rests on a few simple principles. This report will state some of these principles and discuss problems which arise when special diets are prescribed.

Diabetic Diets.

The details of the diabetic core diets have already been reported (Woodhill and Logan, 1955).

[1] The diet sheets have been evolved from the cooperative efforts of physicians and dietitians. All the participants are too numerous to cite. Printed sets are available for 5s. from the Royal Newcastle Hospital.

Two calorie levels of diabetic diets are needed. A lower level of about 1800 calories is prescribed successfully for obese patients, while a level of about 2400 calories is needed to cater for patients on insulin therapy. The two calorie levels are readily adjusted to suit individual needs by the addition or subtraction of a 100 calorie portion—for example, one thin slice of bread (one ounce) and one teaspoonful of butter.

A food information sheet or substitution sheet accompanies the diabetic diet sheets. This gives the diabetic patient additional information; for example, the diet sheet states that two pieces of fruit are allowed and the food information sheet sets out what is meant by "a piece of fruit". The sizes of pieces of fruit, each of which contain 10 grammes of carbohydrate, are listed under fruit portions. The starchy vegetables are listed as one-quarter, one-third or one-half cup according to their carbohydrate concentration. The most important section is the list of bread substitutions. This states that if the patient wishes to forgo a slice of bread, then he can exchange it for some other starchy food, such as porridge, cooked rice or biscuits, or substitute it for extra fruit or vegetables. The meat substitution list draws attention to the fact that all the commonly used protein foods are interchangeable, ounce for ounce, and that the fatless meats, such as fish, chicken or veal, have two extra teaspoonsful of butter to replace the fat that accompanies the beef, lamb, etc. The butter substitutions allow cream or oil to replace butter. This is useful for salad dressings. Bacon is regarded as a fat substitution.

The basis of a diabetic diet is that sugar and foods containing sugar are eliminated, because sugar is 100% carbohydrate and very low in satiety value. Foods rich in starch are strictly limited; bread is approximately 50% carbohydrate and it is measured or weighed. These modifications mean that the protein content is increased, in order to provide meals which satisfy hunger and conform to the usual Australian meal pattern. This makes a diabetic meal expensive. Some diabetic pensioners are eligible for food orders for milk, eggs, fruit and vegetables. These food orders assist them to pay for their food. The State Department of Labour and Industry and Social Welfare guarantees to pay the tradesmen for a limited quantity of the foods.

Diets of Low Caloric Value.

In diets of low caloric value planned for weight reduction, foods containing concentrated carbohydrates, such as sugars, lollies, cakes and puddings, are eliminated. Breads, cereals and foods containing a relatively high percentage of starch are limited. Bulky foods with a high water content, and so a correspondingly low carbohydrate content, are used, as they provide bulk. Fats must be reduced as low as possible. Protein foods, such as meat and eggs, are used to replace some of the foods which have been eliminated or restricted. Protein foods are not so concentrated in calories as foods containing a high percentage of sugar and starch, and protein foods have a high satiety value. The quantity of protein foods needed makes a diet of low calorie value expensive. The patients must be educated to consume more protein foods lest they satisfy their appetite with the cheaper and easily available carbohydrate.

Protein-Rich Diets.

In a protein-rich diet, the aim is to provide an intake of approximately 100 grammes of protein per day. Whether the intake reaches this level will usually depend upon the appetite and the food habits of the patient. Dried skim milk is the best and cheapest source of additional protein. Three rounded tablespoonsful per day combined with large servings of protein foods at each meal will bring the protein level to approximately 100 grammes per day. (One rounded medicinal tablespoonful of dried skim milk contains approximately seven grammes of protein.)

Diets of Low Fat Content.

It is convenient to consider three levels of fat as examples of this type of dietary modification. In calculating a diet of low fat content, it is found that the fat and protein occur together in many foods, so that it is a problem to restrict the intake of fat and maintain that of protein at levels consistent with good nutrition. In order to satisfy the appetite and maintain an adequate level of calories, the carbohydrate intake has to be increased. Many foods containing carbohydrate need fat to accompany them in order to make them palatable; for example, bread is eaten with butter. One of the important functions of fat is to concentrate the calories, so it is difficult to satisfy the appetite and maintain weight when patients are prescribed diets of low fat content.

The 30 gramme fat diet is considered the lowest level of fat restriction which is practicable. This degree of fat restriction is drastic compared with the normal amount which most Australians like to eat. It is deficient in preformed vitamin A, although there is no limitation of the intake of green and yellow vegetables, which are rich sources of the precursor to vitamin A—the fat-soluble pro-vitamin carotene. Most patients would find this diet very difficult to maintain for a long period; it has a low caloric value, so would probably result in a loss of weight.

The 50 gramme fat diet contains 20 grammes of fat more than the minimum fat diet. It allows some whole milk (enough for tea and milk puddings) and a little more butter than the 30 gramme fat diet and is nutritionally adequate.

The 50 gramme fat, 130 gramme protein diet, combines a low fat content with a high protein level.

Sodium-Poor Diets.

If salt restriction is ordered, the actual intake of food should be carefully checked. Saltless food is so unacceptable to some patients that the diet may become grossly inadequate.

Two levels of salt restriction are often prescribed—the 0·5 gramme sodium diet and the 1·0 gramme sodium diet.

Ulcer Diets.

Four types of diets are usually prescribed in the dietary treatment of patients with gastric and duodenal ulcers. All the diets have two principles in common, frequent feedings and a high fat content. Examples of these diets are as follows.

Ulcer I Diet.

In this diet the food enters the stomach hourly throughout the day. It is usually given from 5.30 a.m. till 9.30 p.m. Patients are placed on this diet for short periods only. It consists of milk and cream mixture, and is below the recommended dietary allowances in protein and thiamin. Orange juice is offered in addition to the milk and cream mixture.

Ulcer II Diet.

This is more liberal than an Ulcer I diet, and some simple foods which are considered to be easy to digest are added. It maintains the hourly feedings. The time span for feedings is from 7 a.m. till 9 p.m., with a larger feeding from "foods allowed" at 8 a.m., 12 noon and 5 p.m., to correspond to the regular meal hours. It is below the recommended dietary allowance for thiamin unless "Vegemite" or "Marmite" is included. This is a transition diet and difficult to follow unless the patient is in bed or resting at home. It is often ordered for three to five days, and then the patient progresses to an Ulcer III diet. No stimulating foods are allowed, and the vegetables and solid foods are very finely divided in the form of purées. From experience it has been found that diluted citrus fruit juice is sometimes tolerated better after food than before it. It is important that a rich source of vitamin C should be included in the diet.

Ulcer III Diet.

Some ulcer patients consider that the type of food they eat is directly related to their symptoms. This type of person usually prefers to have a set diet, such as an Ulcer III diet, which he can follow most of the time. It is therefore necessary that a long-term diet such as this

should be adequate in all nutrients. The intake of food such as milk, meat, eggs, cheese, oranges and "Vegemite" or "Marmite" is stressed to ensure an adequate intake of protein, vitamin C and thiamin. The Ulcer III diet is much more liberal than the Ulcer II diet. It is bland in character—it contains no stimulating food such as spices, curries or concentrated meat extractives. All soft vegetables which can be mashed are allowed. Skins or seeds of fruits and vegetables are excluded from the diet. The importance of citrus fruit is stressed, and six feedings a day are required.

Ulcer Diet Rules.

Some ulcer patients do not need a strict or set diet; all they need to do is to follow a few basic dietary principles. These are the rules common to all ulcer diets—i.e., adequate nutrition, frequent feedings and a high intake of easily digested fat.

Low-Residue Diet.

Residue can be of two types—fibre, and undigested food, not fibre. The skin of fruit and cellulose in vegetables are examples of fibre, while the undigested residue of milk, some fried foods and the gristle of meat are examples of the other types of residue. A low residue diet has a low content of both types of residue.

Conclusion.

The next step in the development of diet therapy is that all those who prescribe or supply special diets should investigate the results of the dietary prescription. The efficacy of special diets can often be evaluated, and unless this is done whenever possible, professional time may be wasted and the patient subjected to unnecessary modification of his way of life. In some cases the treatment produces an obsessional food crank.

References.

WOODHILL, J. M., and LOGAN, J. L. (1955), "Diabetic Diets Simplified: The Core Diet", M. J. AUSTRALIA, 2: 960.

Reviews.

Science News: Rockets and Satellite Research Number. Edited by Archie and Nan Clow; No. 48; 1958. Victoria: Penguin Books Proprietary, Limited. London: The Whitefriars Press, Limited. 7" x 4", pp. 142, with illustrations. Price: 4s.

THE whole of this issue of *Science News* has been given over to the highly topical subject of rocket and satellite research. It includes a chapter on space medicine, with particular reference to the mechanical stresses, the environmental factors and the hazards to life and health associated with space travel. In general, however, the book is not concerned so much with human space travel, which remains an extremely speculative subject, as with rockets and what they may reasonably be expected to reveal to us about the universe outside our own planet. The approach is conservative and informed, but by no means elementary to the ordinary reader.

Lectures on the Scientific Basis of Medicine. British Postgraduate Medical Federation, Volume 6, 1956-57; 1958. London: The Athlone Press. 8¼" x 5", pp. 406, with many illustrations. Price: 45s. (English).

IN accordance with their policy of publishing a selection of the lectures delivered annually, the British Postgraduate Medical Federation has included in this volume twenty-one of the twenty-nine lectures delivered during the winter of 1956-1957. They are described as being designed for graduates in medicine looking forward to careers as clinical teachers and consultants in medicine and surgery and their special branches, or to careers in research in the medical sciences. The lectures for the most part deal with subjects that carry further the problems dealt with in the earlier volumes and reflect the use of new techniques and the trends of modern research. Of considerable topical interest is the opening lecture by Sir John Cockcroft on the biological significance of atomic energy. Notice is taken of the Sherrington Centenary by an article on "Cajal and Sherrington" by E. G. T. Liddell. Other articles deal with the homotransplantation of organs, the physiology of skeletal tissue in culture, arterial substitutes, lung function tests, the principles of heart-lung machines, social psychiatry, causes of pain, neuro-chemistry for the metabolism of acetylcholine in nervous tissue, factors influencing the action of neuromuscular blocking substances, phospholipids, the synthesis and degradation of polysaccharides, essential fatty acids in nutrition and their relation to other vitamins, the control of fat metabolism, the role of the endocrine system in breast cancer, the biliary excretion of thyroid hormones, resistance of staphylococci to antibiotics, poliomyelitis, and the electron microscope in the study of viruses.

Books Received.

[The mention of a book in this column does not imply that no review will appear in a subsequent issue.]

"Myasthenia Gravis", by Kermit E. Osserman, M.D., F.A.C.P.; 1958. New York and London: Grune and Stratton, Incorporated. 9" x 5¾", pp. 296, with 58 illustrations, 24 tables. Price: $10.00.

A monograph presenting modern views on myasthenia gravis and its management based on extensive experience.

"Sanity, Unheard Of", by Hugh Woodworth, 1958. Victoria, British Columbia: The Sumas Publishing Company Limited. 8¼" x 5", pp. 112. Price: $3.00.

A study of man and his problems in a society that is insane.

"Discussions on Child Development", edited by J. M. Tanner, M.D., D.Sc., D.P.M., Bärbel Inhelder; Volume III; 1958. Victoria: Melbourne University Press. London: Tavistock Publications, Limited. 8½" x 5½", pp. 224, with illustrations. Price: 46s. 6d.

A report of the third meeting of the World Health Organization Study Group on the Psychobiological Development of the Child, held in Geneva in 1955.

"Recent Advances in Cerebral Palsy", edited by R. S. Illingworth, M.D., F.R.C.P., D.P.H., D.C.H.; with a foreword by Norman B. Capon, M.D., F.R.C.P., F.R.C.O.G.; 1958. London: J. and A. Churchill, Limited. 9¼" x 6", pp. 404, with 136 illustrations. Price: 50s. (English).

Fourteen contributors deal with a subject in which there has been renewed interest and hope.

"Pathophysiology in Surgery", by James D. Hardy, M.S., M.D., F.A.C.S.; 1958. Baltimore: The Williams and Wilkins Company. Sydney: Angus and Robertson, Limited. 10" x 6½", pp. 724, with 278 illustrations. Price: £10 9s.

A new approach to surgical physiology.

"Radioactive Isotopes in Clinical Practice", by Edith H. Quimby, Sc.D., Sergei Feitelberg, M.D., and Solomon Silver, M.D.; 1958. Philadelphia: Lea and Febiger. Sydney: Angus and Robertson, Limited. 9¼" x 5¾", pp. 452, with 97 illustrations. Price: £5 10s.

Compiled from experience in conducting a course on the subject.

"Autopsy Diagnosis and Technic", by Otto Saphir, M.D.; Fourth Edition; 1958. New York: Paul B. Hoeber, Incorporated. 7½" x 5", pp. 576, with 78 illustrations. Price: $8.50.

An essentially practical book for the student and for the practitioner who does not perform autopsies frequently.

"Radiation Protection", by Carl B. Braestrup and Harold O. Wyckoff; 1958. Springfield, Illinois, U.S.A.: Charles C. Thomas, Publisher. 9" x 5¾", pp. 384, with many illustrations. Price: 80s.

Intended as an over-all guide to protection against radiation.

"Obstetrical Practice", by Alfred C. Beck, M.D., and Alexander H. Rosenthal, M.D. Seventh Edition; 1958. Baltimore: The Williams and Wilkins Company. Sydney: Angus and Robertson, Limited. 10" x 6½", pp. 1120, with 952 illustrations. Price: £7 14s.

The essentials of obstetrical practice presented for undergraduate students and young practitioners.

The Medical Journal of Australia

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MEDICINE IN THE NORTHERN TERRITORY.

OPPORTUNITIES of wide variety and scope are open to the Australian practitioner who is interested in something different from the routine of practice in the great metropolitan centres or in the country towns that lie within Australia's civilized coastal fringe. Mention has been made in these columns in recent times of the challenge of New Guinea and of the Antarctic. Another such area is the Northern Territory. It must be agreed that in the past conditions for medical work in many of these places off the beaten track were in general so primitive and so difficult as to cause frustration to all but the most adventurous in mind. This has now very largely changed. Medicine has advanced so greatly in recent years that primitive medical practice has become intolerable to any doctor of modern training. Fortunately, at the same time, developments in communication and transport and the acceptance of increased responsibilities by, for example, government departments have made it possible for the essentials of modern medical treatment to be brought to outlying areas. This fact is brought home strikingly by a series of articles on the health services of the Northern Territory published in *Health*, the journal of the Department of Health of the Commonwealth of Australia, in its issue for December, 1957.

The Northern Territory has an area of over half a million square miles, and occupies one-sixth of the total area of Australia. Its total population, however, is only 33,000, including 1600 part-coloured persons and 15,200 aborigines. Most of the non-aboriginal population lives in the towns, so that the Territory is characterized by the sparsity of its population in its "outback" areas. There is naturally a concentration of population in the administrative centre of Darwin, with its sea-port and air-port facilities, and smaller concentrations are found at the other main centres, Alice Springs, Batchelor, Katherine and Tennant Creek. These, however, are the only centres of any importance, and scattering of the small remaining population over vast areas is inevitable from the nature of the main occupations of the people of the Territory, which are the raising of beef cattle and the mining of uranium, copper, gold and other minerals. Rice-growing, which has been under development since 1955, may well come to be a third major occupation. In a foreword to these articles, the Minister for Health, the Honourable D. A. Cameron, remarks that mention of the Northern Territory creates for most Australians a mental concept of vast areas in the north of the continent, where men and women, year after year, pursue their callings under difficulties and stresses of which the city-dweller in the south can have little real appreciation. At the same time he points out that, with the march of progress, there may now be found in remote homesteads, mission stations and settlements many of the amenities enjoyed by those same city-dwellers. In addition to household conveniences such as electricity and refrigeration, modern science has brought the magic of radio to eliminate distance and thus bring residents of these outlying areas into constant touch with the world outside the Territory. More important still, it has brought them in touch with their neighbours, even though the nearest of them may be fifty or a hundred miles away.

Of major importance in combating any sense of loneliness and encouraging morale amongst those who are in the scattered areas is the provision of a sound and reliable health service. This it would appear the Northern Territory now has. Each of the four main centres of population, Darwin, Alice Springs, Katherine and Tennant Creek, has a well-equipped general hospital, and there are smaller hospitals at Batchelor and at the Bagot native reserve. There are seven medical officers at the hospital in Darwin, four in Alice Springs, and one each at Katherine and Tennant Creek. A medical officer visits the other centres regularly. People in more remote areas cannot as a rule be brought to hospital for treatment except in cases of extreme emergency, and routine visits are made to these out-stations by medical officers using aircraft of the Aerial Medical Service, or in some cases travelling by road. A fully staffed Commonwealth Health Laboratory at Darwin provides for pathological investigations, including those associated with the special surveys and investigations of native health which are an intrinsic part of the general medical work of the Territory. The Northern Territory Leprosarium, which is situated twelve miles from Darwin, is furnished, equipped and run in the modern manner. There are, in addition, in the Northern Territory several private practitioners, and it should not be thought that the area is a government preserve.

Inevitably, a great deal of the activity of the Northern Territory Medical Service is of a mobile character. Of greatest importance is the Aerial Medical Service, based on Darwin and Alice Springs, which works in close cooperation with the Royal Flying Doctor Service. Since nearly all of the Northern Territory lies north of the Tropic of Capricorn, it is subject to tropical rainfall conditions, and has a wet season and a dry season. Throughout the "wet", surface travel off the main bitumen roads is impossible, and the aerial service becomes indispensable. It now operates three aircraft with three pilots; the De Havilland Drovers, at present in use, are now in process of being replaced by De Havilland Doves, which have a superior range and performance. These aircraft not only are used as ambulances to bring patients into the centres for treatment, but are an important factor in carrying out surveys and other health investigations by medical and dental officers. Immunization against tetanus, diphtheria, whooping-cough and poliomyelitis of the children of the outback is mostly carried out through this same agency. The extent of the work of the Northern Territory Aerial Medical Service is indicated by the fact that during the year ended June, 1957, a total of 128,000 miles was flown,

and 520 patients were carried to hospital for treatment. Radio networks, spread over practically the whole of the Territory, based on Darwin, Alice Springs, Wyndham in Western Australia and Cloncurry in Queensland, are of major importance in medical, business and social matters. The Schools' Medical Service also has a wide range. The Schools' Medical Officer roves far and wide, in carrying out routine physical examination of all children attending both pre-school centres and schools under the supervision of the Assistant Supervisor of Education. The only children not examined by the Schools' Medical Officer are those at the Native Welfare Settlement School—that is, full-blooded aborigines who are examined by medical officers during native health surveys. Children attending the pre-school centres are examined once a year if possible, and it is aimed to make a medical examination of all children attending primary and high schools at least three times during their school life. A full dental service is also provided, both at permanent dental clinics in Darwin, Batchelor and Alice Springs, and through special school clinics and mobile units which travel by aircraft, panel van and boat to cover the whole of the Territory.

In the field of public health, quarantine is prominent, as Darwin is one of the chief points of entry for overseas aircraft. The extent and significance of this work will be seen when it is realized that aircraft entering Darwin have passed through the Middle East and Asian countries in which serious quarantinable disease are still endemic, and that the number of such aircraft which arrive at Darwin air-port every year is approximately 1050 and is always increasing. An Infant Welfare Service is available in Darwin and its vicinity; two dietitians provide a supervisory and advisory service in nutrition for both the native and the European population, and environmental health is supervised by the staff of the Hygiene, Sanitation and Food Inspection of the Division.

It is interesting to note the statement that, in spite of the tropical climate and undeveloped state of the Territory, endemic tropical diseases are few in number and affect the European population very little. The tropical diseases listed as occurring are hookworm infestation, trachoma, leprosy, yaws, benign malaria, ulcerating granuloma of the pudenda and bacillary dysentery. Less common are amœbiasis, *Strongyloides* infestation, leptospirosis, mite-borne typhus and epidemic encephalitis. A serious incidence of infectious disease amongst the native people has occurred only since they have come in contact with the white population; and the ironical situation now obtains that, with the encouragement of white settlement into remote areas, more and more contact with aborigines is likely to occur, and the aboriginal threatens to hand back the diseases he has received in the past from the invader of his tribal territory. Consequently control of these diseases is one of the matters particularly occupying the medical services in the Territory. Native health surveys are in the hands of three medical officers, one in the northern areas, one in the Alice Springs area and one in the Katherine district. The general aim of these surveys is the prevention of disease, since experience has shown that in most cases natives do not ask for medical treatment; therefore health checks at regular intervals are essential if disease is to be efficiently controlled.

In each of the six Australian States a division of the Commonwealth Health Department works alongside a State Health Department. In the Northern Territory, on the other hand, the Commonwealth Administration is on its own and has to carry out the function of these two agencies. The Northern Territory Health Division is controlled by the Commonwealth Department of Health from its central administration in Canberra, but responsibility for the internal administration of the Division is vested in the Director of Health stationed at Darwin. Details of his administrative set-up, of the medical and allied staff operating in the Northern Territory and of their salaries and general working conditions are all set out in this number of *Health* and are available to those interested. Our purpose at the moment is to draw attention to this field of medical activity, which is of great significance to Australia and its future. It is important that its challenge and appeal should be brought to the notice of the younger generation of Australian medical practitioners.

Current Comment.

CARCINOMA OF THE LUNG.

IT is no longer news that cancer of the lung is alarmingly common and that each year more and more cases are being reported in most countries where adequate statistics are kept. As with other visceral cancers, early diagnosis is rare, and the results of treatment are disappointing. Much useful information is to be found in a recent book on the subject edited by J. R. Bignall;[1] this is Volume I of a series, under the general editorship of D. W. Smithers, entitled "Neoplastic Disease at Various Sites". The five sections of the volume deal with mortality, causation, pathology, course and treatment. It is pointed out that five separate industries carry a specific risk of lung cancer—namely, the mining of some radioactive ores, the refining of nickel, the manufacture of chromates and of asbestos, and the production of gas. In all of them there is a long latent interval between the first exposure and the appearance of the growth; in each case the action is specific and not just the result of tissue injury and reaction. The histology of the cancers varies; those due to radioactive ores are generally squamous, oat-celled or undifferentiated, and those due to the other hazards are mainly adenocarcinomatous. The number of neoplasms from these causes is only a small fraction of the total.

Richard Doll, writing on "The Smoking of Tobacco", concludes that cigarette smoking is one of the causes of lung cancer. He bases his belief on the following points: (i) the histological changes that frequently precede the development of cancer are also related to smoking; (ii) there are several carcinogenic substances in tobacco smoke; (iii) extracts of tobacco tar are capable of causing skin cancer in animals. Doll adds that not all investigators accept his conclusions. On the question of atmospheric pollution he states: "On present evidence it seems probable that atmospheric pollution is responsible for a proportion of cases." Other factors that he discusses are non-industrial radioactivity, respiratory infection and heredity. His conclusions about these are three. The first is that atmospheric radioactivity "cannot be responsible for the great increase which has taken place in the incidence of the disease"; nor can it account for the predominance of the disease in men. The second is that there is some association between chronic bronchitis and lung cancer, but it does not necessarily follow that the association is

[1] "Neoplastic Disease at Various Sites", General Editor, D. W. Smithers, M.D., F.R.C.P., F.F.R.; Volume I, "Carcinoma of the Lung", edited by J. R. Bignall, M.D., M.R.C.P.; 1958. Edinburgh and London: E. and S. Livingstone, Limited. 9¾" × 6¼", pp. 305. Price: 55s. (English).

direct; at the present moment it must be concluded that the role of respiratory infections (including tuberculosis) in predisposing to lung cancer is uncertain. The third is that lung cancer does not seem to be related to blood groups, and there is no significant hereditary proneness.

K. F. W. Hinson writes on "Origin and Appearances of Carcinoma of the Lung" and "The Spread of Carcinoma of the Lung". He states that all primary lung cancers arise from the epithelium of the bronchi, bronchioles or mucous glands; alveolar cells have no resemblance to the cells of human neoplasms. Pleomorphism is common in lung cancers, and this makes histological classification difficult, but three main groups are found: (i) squamous carcinoma, (ii) adenocarcinoma, (iii) undifferentiated carcinoma. Squamous carcinoma seems to be the least malignant type and is the one most often found in heavy smokers. In many cases it is situated centrally. Adenocarcinomata do not seem to be associated with smoking, are more common in women than squamous growths, and are usually sited peripherally. The undifferentiated group includes a small number of very malignant "oat-cell" growths; most of these are within bronchoscopic range. All lung cancers show early extrabronchial extension through mucosal, peribronchial and perivascular lymphatics, with eventual spread to lymph nodes. Lymph node involvement is lowest with squamous growths and highest with oat-cell growths. Direct invasion of small blood vessels is frequent. Invasion of the atrium occurs by extension from the pulmonary vein; infiltration, with thrombosis, of the larger branches of the pulmonary artery leads to infarction of the lung. Metastases have been found in almost every organ of the body; the commonest sites are regional lymph nodes, liver, adrenals, bones, brain and kidneys.

J. R. Bignall, in the section on "The Course of Carcinoma of the Lung", states that main bronchial growths have the lowest resection rate and the lowest survival rate. Less than one-quarter of all patients with lung cancer come to resection, either because of poor general condition or because of the extent of the growth. Adenocarcinoma, the rarest of the three main types, is proportionately more common in women than in men. It is usually peripheral, and, although differentiated, it is very malignant; yet if it is removable, the prognosis seems to be better for it than for the less malignant squamous carcinoma. On the whole, the fewer the symptoms the better the chances of successful treatment. The uncertain "alveolar" carcinoma is probably an adenocarcinoma arising in a bronchiole. It has no characteristic symptoms and tends to cause a long illness, ending in respiratory failure and asphyxia. Multiple lesions in the lung are common and are probably due to bronchial embolism by tumour fragments rather than to their being several different sites of origin within the lungs. The prognosis is very bad.

Under the heading "Unusual Manifestations", Bignall describes sensory neuropathies and polyneuritis. He states that sometimes the clinical picture resembles that of myasthenia gravis. These nervous manifestations may occur while the cancer is still too small to be detected. Pulmonary osteoarthropathy may be the first sign of lung cancer. It is well known that the joint and bone symptoms subside dramatically on removal of the growth; it is not so well known that they may disappear with simple ligation of the pulmonary artery without removal of the neoplasm. In passing it may be noted that others have reported similar relief from section of the vagus nerve. Among endocrine disturbances, gynæcomastia, Cushing's syndrome and Addison's disease are mentioned. Metastases may account for some of these changes, but often no metastases are found.

Treatment is discussed under three headings—namely, surgical treatment (W. P. Cleland), radiotherapy (D. W. Smithers) and chemotherapy (D. Galton and R. Papac). Cleland describes the usual palliative, conservative and radical operations after first detailing the factors to be considered in assessing operability. Conservative surgery has much to offer, and careful thought should be given to Price Thomas's operation of excising a part of the main bronchus together with the involved lobe. By means of end-to-end suture of the bronchus much valuable normal lung tissue can be saved. Smithers states that radiotherapy is generally given by means of X rays, particularly for the relief of symptoms such as superior mediastinal compression, hæmoptysis and painful metastases. As a rule, patients with inoperable growths and no great distress should not be irradiated. "No real trial of supervoltage irradiation in selected operable cases has yet been made." "Several new radioactive isotope treatment methods are being tried, but most of them offer little prospect of success." Galton and Papac express the opinion that nitrogen mustard still seems to be the best chemotherapeutic agent available; but side effects are troublesome, and remissions rarely last more than six months. Superior vena caval obstruction can be relieved and toxic symptoms diminished by means of nitrogen mustard, and there is also evidence that it can cause regression of the tumour and its metastases. Nevertheless, Galton and Papac comment that ten years' experience with nitrogen mustard therapy has made it impossible for them to be enthusiastic.

HEALTH AND VITAL STATISTICS IN THE UNITED STATES OF AMERICA.

EACH year the National Office of Vital Statistics, Washington, publishes a summary of the more important or more readily comprehended tables from their larger official publications, illustrating the figures by appropriate graphs. The latest of these[1] is to hand, and we may note some of the features. The population of the United States in the period from 1950 to 1957 has increased by 20,000,000. This increase is almost as great as that of any previous 20-year period before 1940. This phenomenal rate of population increase has been attained because of the low mortality and the very high fertility rates of the post-war years. Registered live births have remained at almost 25 per thousand of population since the war. Infant mortality has shown a tendency to become stabilized at 26 per thousand in recent years. The stillbirth rate is still falling, and is now about 16 per thousand. Maternal mortality has fallen from about 6·0 per thousand in the 1930's to 0·4 per thousand in 1957. Although the proportion of old persons has continued to increase, the crude death rate has fallen. Some of the improvements in mortality can be read off from the average future lifetime (expectation of life) at each age. Great advances have occurred at all ages for females and at the younger ages for males. The improvement for males at age 45 years between 1950 and 1956 was trivial, but females at the same age gained one year over this short period. Since 1900, males at this age have gained three years, but females have gained almost seven years of expected life. There is still considerable disparity between the mortality of the white and non-white sections of the community. Although the annual deaths from tuberculosis are decreasing, they still form the bulk of death from infective disease. The inoculation campaign has been followed by a great fall in the poliomyelitis deaths. Each year there are over 100 notifications of cases of endemic typhus, but no deaths have been recorded since before 1952. Rabies and Rocky Mountain spotted fever each account for about a dozen deaths each year; the case fatality in the former is almost 100%, but in the latter only about 5%. Infectious hepatitis is the cause of about 800 deaths *per annum*; as in Australia, this number is greater than the total of deaths from measles and diphtheria combined. Some tables are given of deaths by cause by age, which show very clearly that accidental deaths are the most important group of causes of death from ages one to 44 years. This little volume must serve a very useful purpose in America and is of interest to us here for comparisons.

[1] "Summary of Health and Vital Statistics", U.S. Department of Health, Education and Welfare. Public Health Service, Washington: National Office of Vital Statistics. 11" × 8½", pp. 28, with many illustrations. Price not stated.

Abstracts from Medical Literature.

MEDICINE.

Phæochromocytoma and Diabetes.

P. FREEDMAN *et alii* (*Quart. J. Med.*, July, 1958), after discussing four patients with phæochromocytoma and diabetes mellitus, describe their search for medullary tumours among 144 diabetics. For this purpose they used a screening test which involves intravenous injection of urine into cats and comparison of the blood pressure response with that produced by standard solutions of adrenaline and noradrenaline. When this test was abnormal, chemical assay of catecholamines was undertaken. The experience with this test enabled the authors to reach certain useful conclusions. Firstly, patients between the ages of 20 and 50 years with hypertension and diabetes should be investigated to exclude the possibility of phæochromocytoma. Secondly, severe hypertension is rare in cases of simple diabetes mellitus but is common when this disease is associated with phæochromocytoma, and advanced hypertensive retinopathy (as opposed to diabetic retinopathy) is rare in diabetes. When severe hypertension or advanced hypertensive retinopathy is found in patients with diabetes, a search for phæochromocytoma should be instituted. The mechanism of diabetes associated with phæochromocytoma is uncertain. Removal of the tumour does not cure the diabetes in every case. The possibilities discussed include a second tumour, exhaustion of the islets of Langerhans following the prolonged hyperglycæmic effect of adrenaline, and the production of excess glucocorticoids as the result of adenohypophyseal stimulation by adrenaline. Finally, the rare association between idiopathic diabetes and phæochromocytoma may explain certain cases illustrating this combination.

Rupture of the Heart during Anticoagulant Therapy.

H. F. LANGE AND S. AARSETH (*Amer. Heart J.*, August, 1958) observed, among 1229 cases of fatal cardiac infarction coming to autopsy, 81 cases of rupture of the heart. It appeared that overdosage with anticoagulants increased the risk of cardiac rupture and of hæmopericardium from other causes.

The Pickwickian Syndrome.

H. GOTZSCHE AND V. P. PETERSEN (*Acta med. scand.*, volume 161, fascicule 5, 1958), discussing the Pickwickian syndrome, state that the association of obesity and an overpowering desire for sleep was vividly described by Charles Dickens, and point out that it has recently been shown that loss of consciousness is associated with carbon dioxide anæsthesia following alveolar hypoventilation. The authors describe such a case in which studies of pulmonary and circulatory functions were performed. The fundamental abnormality appears to be hypoventilation due to immobility of the chest wall and diaphragm, although no explanation is offered for the fact that not all obese patients develop the syndrome. Alveolar hypoventilation causes hypoxia and hypercapnia with a fall in the sensitivity of the respiratory centre to carbon dioxide. This results in attacks of periodic breathing and is associated with pulmonary hypertension and incipient right heart failure. Periodic breathing is abolished by weight reduction.

Coarctation of the Aorta.

R. NICKS (*Brit. Heart J.*, July, 1958), in a study of 44 consecutive cases of coarctation of the aorta, pleads for the early diagnosis and surgical treatment of this abnormality in patients with progressive heart failure. He proposes 14 years as the age of election for operation.

Late-Night Calorie Supplement.

J. H. FRYER (*Amer. J. clin. Nutr.*, July-August, 1958) describes an investigation into the effects of a late-night calorie supplement upon body weight and food intake in man. Twelve male students were given a one-thousand-Calorie liquid supplement each night for eight weeks. The group mean weight showed a significant increase, the rate of increase falling off in the later weeks. The possible causes for this are discussed. The calorie intake at regular meals decreased by approximately 500 Calories a day during the period of supplementation, but the variation in percentage compensation between individuals was considerable. The significance of these findings is discussed in terms of the variation in obesity resistance and obesity proneness which results from the greater or lesser efficiency of the homœostatic control of energy equilibrium. Observations of blood sugar levels and rates of gastric emptying showed that the decreased intake of food at normal meals attendant upon late-night calorie supplementation could not readily be attributed to a glucostatic mechanism of appetite control or to a mechanism dependent upon the mechanical effects of nutrients on the gastro-intestinal tract.

Electroencephalographic Study Before and After Salk Vaccination.

E. L. GIBBS AND F. A. GIBBS (*J. Amer. Med. Ass.*, June 21, 1958) have made an electroencephalographic study of 852 persons receiving Salk vaccine. The object was to determine whether Salk vaccine, when administered as part of a programme of mass immunization against poliomyelitis, caused brain disorder in some persons. The subjects were infants, children, adolescents and adults, and the electroencephalograms were taken before and after the first, second and third inoculations of Salk vaccine. All precautions were taken to guard against the possibility that preexisting electroencephalographic abnormalities might go unrecognized, to be picked up after vaccination. No electroencephalographic abnormalities were induced by the vaccination in initially normal people. The possibility that vaccination might cause detectable injury in brains already handicapped by previous disease or injury was also investigated. A group of 106 persons with brain disorders, including 44 with epilepsy, were studied electroencephalographically. Again no evidence of harm from the vaccination was obtained. The vaccines used in this study were commercial preparations from two drug companies, and the evidence showed that these preparations could be given safely to patients with or without manifestations of preexisting cerebral disease.

Jet Injection in Immunization for Influenza.

E. A. ANDERSON, R. B. LINDBERG AND D. H. HUNTER (*J. Amer. Med. Ass.*, May 31, 1958) have carried out a large-scale field trial of jet injections for influenza immunization. The clinical material consisted of more than 10,000 service personnel who were to receive hypodermic injections of influenza vaccine. The "Presso" jet machine was used, and 20,145 injections were given. The machine is capable of generating pressures between 135 and 150 atmospheres (2000 to 2200 pounds per square inch). As many as 734 injections per hour were given. Problems of technique were readily solved, and asepsis was easily maintained. The antibody responses of 52 subjects who received influenza vaccine by this method were compared to the responses of 27 subjects inoculated by needle and syringe, and there was no significant difference in the results. The new technique made it possible to give injections to large numbers of people rapidly, safely, simply and with minimal psychological trauma. The authors state that the advantages of the injector unit include the following factors. It can be used in any location, is easily transportable, and depends solely upon the availability of electricity, which could be supplied by a portable generator for field use. The sterilization facilities and amounts of equipment needed to deal with very large numbers of people are minimal. The dangers of transmitting diseases such as hepatitis are absent. The procedure may be carried out by relatively untrained personnel. Maintenance of equipment is feasible, with a minimal amount of training. However, the injected material must be non-viscous and in aqueous solution, and the diameter of the aggregate particles must be less than 0·005 inch. The machine is still in the developmental stage.

Reduction of Sputum Viscosity in Chronic Bronchitis.

W. ROBINSON, P. B. WOOLLEY AND R. E. C. ALTOUNYAN (*Lancet*, October 18, 1958) state that the three basic factors in the syndrome of chronic bronchitis are infection, bronchospasm and abnormal sputum. The mucosa of the bronchial tree is abnormal, and the mucus-secreting glands, which are over-developed, produce an abnormally viscid and tenacious mucus in excessive quantities. The authors have investigated a method of reducing the viscosity of the sputum. The clinical material consisted of 36 patients with chronic bronchitis, and the treatment was by insufflation into the peripheral bronchial tree of powdered desoxyribonuclease and chymotrypsin. A special apparatus was evolved, of such design that only inspiration through it formed powder smoke, and manual coordination was not required. This is in contra-

distinction to the "Armour" penicillin insufflator, in which the powder was dispersed by compression of the bulb at the beginning of a deep inspiration. With most patients, owing to incoordination and wetting of the apparatus with saliva, the latter method was unsuitable. The authors state that the apparatus that has been evolved is compact and convenient for use by out-patients. Objective evidence of reduced sputum viscosity was obtained in nearly all cases during the period of treatment; 67% of the patients considered the treatment helpful. Even better results are expected from a more homogeneous chymotrypsin powder with a particle size of about 3μ combined with a bronchodilator. A full description of the apparatus is given.

Bronchodilators in Chronic Bronchitis.

W. ROBINSON, P. B. WOOLLEY AND R. E. C. ALTOUNYAN (*Lancet*, October 18, 1958) have applied the instrument they evolved to reduce the viscosity of the sputum in chronic bronchitis to the use of other drugs to treat the condition. They state that since bronchospasm is one of the most intractable features of the disease, the bronchodilator drugs appear to be the most obvious group to investigate. Thirty male and nine female patients were investigated, the average age being 45 years. They had all had a chronic productive cough for two or more years, with dyspnœa on exertion and episodes of infected sputum. Nearly all the patients showed an improvement in the forced expiratory volume in one second ($F.E.V._{1\cdot0}$) after inhalation of powdered isoprenaline. In seven cases, protracted isoprenaline therapy brought about no reduction in the bronchodilator response to isoprenaline, determined by the $F.E.V._{1\cdot0}$. Of 19 patients, nine showed an increase in $F.E.V._{1\cdot0}$ after the intramuscular injection of mepyramine. The authors state that mepyramine given by mouth potentiates the isoprenaline response in some cases.

The Health of London Bus Drivers.

L. G. NORMAN (*Lancet*, October 18, 1958) discusses the health of London bus drivers. He states that at the end of 1957 there were 20,250 drivers on the roads of Greater London. Of these, 14,000 were drivers of diesel double-decked buses in the central area, 3000 drove country buses and Green Line coaches, and 3250 drove trolley-buses. The London Transport medical service deals only with members of its staff. Its work is divided into three sections. (i) In the medical examinations section, over 40,000 examinations are made *per annum*. The purpose of medical examinations is to ensure, as far as possible, that an applicant or employee is fit to deal with his work without endangering his own health or safety, or that of others. Applicants for employment in any capacity are medically examined, and employees are examined after long absences due to sickness, and on certain other occasions. Any employee may seek medical advice on any aspect of his health in relation to his work. Trained nurses deal with accidents and sickness at work for the 10,000 employees at larger repair works. (ii) The environmental hygiene section supervises environmental working conditions, to ensure as far as possible that no hazard to health arises to any member of the staff in the course of his work. Matters considered are heating, lighting, ventilation, avoidance of excessive noise, control of chemical hazards, the planning of new buildings and routine inspection visits to all premises. Attention is paid to the maintenance of a high standard of food hygiene in the 186 staff canteens operated by the London Transport. (iii) Under the first-aid section, some 2000 employees are trained to undertake the immediate treatment of accident or sickness. They take this training voluntarily in their own time. Every employee has his own family doctor under the National Health Service. The minimum age for drivers in London Transport is 24 years. A few continue to be employed after the age of 65 years, and all retire by the age of 70 years. In addition to the statutory medical requirements, London transport regulations require drivers to be medically examined (*a*) before employment as a driver; (*b*) before returning to work after absence due to sickness lasting more than 28 days; (*c*) before returning to work after absence due to accident, whether on or off duty, lasting more than three days; (*d*) after any illness causing the driver to stop work during his shift; (*e*) at any time at the request of the management—for example when there is increased frequency of accidents; (*f*) when any driver suffers from vertigo, heart disease, epilepsy, fainting or tuberculosis, whether he is absent from duty or not; (*g*) at the age of 65 years and annually thereafter. In addition the eyesight is examined at the ages of 50, 55, 58, 60, 62, 64 and 65 years and every year after that. From October 1, 1958, drivers will in addition be medically examined at the ages of 50, 56 and 62 years, with an examination of eyesight only at the age of 59 years. The author discusses in detail the selection and training of drivers and the sickness absence of drivers, and shows that these studies indicate that the health of London bus drivers as measured by their sickness absence differs from that of other workers in the industry, and even from that of bus conductors. The reasons for these significant occupational differences are not obvious and are probably multiple. The author finally discusses loss of consciousness while driving, and states that of 28 such cases, 10 were due to coronary thrombosis and 18 to other medical conditions. In four of the coronary thrombosis cases the driver had enough warning to stop his vehicle, but in five he did not, and in three of these an accident resulted. Public transport drivers who suffer from coronary artery disease should no longer drive.

B.C.G.

E. ODIER-DOLFUS AND L. GEORGES-JANET (*Arch. franç. Pédiat.*, November 14, 1957) report from the Pasteur Institute on the results of vaccination with B.C.G. in 212 children of whom 127 had been separated from a sick parent at birth, and 85 had been in contact with tuberculosis. The allergy was found to be quickly established, within an average period of 34 days in children under three months old and of 30 days in those over three months. Few untoward effects were noted, none of them serious. Of these children, 180 were observed for periods of from six months to four years. No occurrence of primary tuberculous infection, or of reinfection, was reported, although some were returned to their families and were in contact with tuberculous subjects. In 34 children a negative tuberculin reaction was observed during the first year; seven gave a negative reaction in the second year, and three in the third year after vaccination. Only one child still gave a negative reaction after these children were revaccinated. The authors conclude that the first year of life is the most favourable for B.C.G. vaccination. However, they consider that this does not eliminate the necessity of separating a child from its tuberculous parent, especially in cases of open infection.

Agranulocytosis.

R. LECOCQ (*Bull. Acad. nat. Méd. (Paris)*, November 5 and 12, 1957) reports the trial of adenine (vitamin B_4) in the treatment of agranulocytosis. He emphasizes the multiple ætiology of the agranulocytic syndrome, the causes including microbic infections, auto-immunization, ionizing radiation, and occupational and medicinal intoxication with various substances. The author states that agranulocytosis due to deficiency was originally ascribed to a lack of vitamin B_8, but is actually due to a lack of adenine. He reports a favourable response to the exhibition of adenine in five cases; one patient had a leucopenia of 3200 cells per cubic millimetre after radiotherapy, another had a leucopenia of 1800 cells per cubic millimetre after a course of chloramphenicol. Adenine was administered both by mouth and by injection.

Metastatic Thyroid Carcinoma Treated by I^{131} and Desiccated Thyroid.

D. D. ADAMS AND H. D. PURVES (*Aust. Ann. Med.*, November, 1958) report a case of metastatic thyroid carcinoma which was effectively treated by I^{131} and desiccated thyroid. The patient was a female child who had developed a goitre at the age of five years. She had a history of having received several doses of therapeutic irradiation for the treatment of birthmarks, between the ages of six months and two and a half years. A diagnosis of thyroid carcinoma with multiple pulmonary metastases was made before operation; sections of the tumour showed it to be an adeno-carcinoma. Treatment with I^{131} produced some regression of secondary deposits; further resolution occurred after the exhibition of desiccated thyroid, in doses of three grains a day, which was apparently responsible for a marked and sustained reduction in the size of the pulmonary and subcutaneous metastases. The lung fields cleared, and have remained clear seven years after the original diagnosis. Reasons are given for suggesting that in cases of thyroid carcinoma with secondary deposits it may be better to try treatment with desiccated thyroid before I^{131} therapy, rather than after it.

Brush Up Your Medicine.

THE INVESTIGATION OF JAUNDICE IN SURGICAL PRACTICE.[1]

A LARGE PROPORTION of cases of jaundice are surgical, particularly in the older age group. In younger people infectious hepatitis plays a more important role, but in patients over 60 years of age jaundice is caused by stone in the common bile duct in one-fifth of cases, and by some form of carcinoma in almost half.

What are the varieties of carcinoma which may cause obstructive jaundice? (i) Primary carcinoma may arise near the ampulla of Vater. These periampullary cancers are relatively slow growing, and draw attention to their presence by producing obstructive jaundice early in their life history. Their radical removal by pancreaticoduodenectomy may be worth while. (ii) Primary carcinoma arising in the parenchyma of the head of the pancreas is more malignant, and resection is not now considered to be warranted by the results. (iii) Primary carcinoma of the extrahepatic biliary passages is seldom removable. It may or may not cause distension of the gall-bladder according to its level. (iv) A secondary tumour may cause obstructive jaundice by deposits in the lesser omentum, in the hilar glands or in the liver itself near the hilum. The primary growth may be in the stomach or colon, or elsewhere in the body (e.g., a melanoma).

Clinical Features.

Table I compares and contrasts the clinical features of obstructive jaundice, as exemplified by stone in the common bile duct and by carcinoma; hepatocellular jaundice, as exemplified by infectious hepatitis; and hæmolytic jaundice as exemplified by acholuric jaundice. Hæmolytic jaundice is usually easily eliminated first. Then the obstructive variety is distinguished from the hepatocellular form by a process of summation of evidence. At the same time a note is made of features which favour stone or carcinoma. As in medicine generally, one must avoid attaching undue significance to any one fact in the history, physical examination or laboratory investigation. In the history a note is made of exposure to possible ætiological factors such as infectious hepatitis, homologous serum hepatitis, chlorpromazine, hydatid disease, etc. Portal cirrhosis must be remembered.

The family history gives positive findings in the congenital type of acholuric jaundice, but negative in the acquired form.

The maximal age incidence of stone in the common bile duct is 30 to 40 years, and of carcinoma of the head of the pancreas is 50 to 60 years. Jaundice at a younger age is more likely to be due to infectious hepatitis.

Obstructive jaundice due to stone in the common bile duct is more common in the female, that due to carcinoma of the head of the pancreas in the male.

A history of flatulent dyspepsia is usually obtained in jaundice due to gall-stones, but not in the other conditions.

In cases of stone the symptoms may have been present on and off for a number of years, whereas in carcinoma the duration is practically always less than a year. In infectious hepatitis the persistence of the jaundice for an unduly long period is a reason to review the diagnosis. The onset of the jaundice is rapid in infectious hepatitis, and slower in the other forms of jaundice.

The trend of the jaundice is most important, and serial serum bilirubin estimations are valuable here. In common bile duct stone the jaundice classically fluctuates owing to a "ball-valve" effect. Recurrent attacks of jaundice of short duration, repeated over a long period, are likely to be due to stone. However, in 12% of cases the stone is tightly impacted at the ampulla of Vater, in which case the jaundice steadily deepens. In biliary obstruction by tumour, the jaundice usually deepens steadily. However, it may fluctuate, particularly in the early stages, and may even clear completely but temporarily. In infectious hepatitis the jaundice usually deepens for a number of days, then gradually fades over a number of weeks. In acholuric jaundice there are crises of jaundice with anæmia.

[1] Based on a paper read in a symposium on jaundice at Sydney Hospital Refresher Week on September 22, 1958. The other two speakers were Dr. B. P. Billington and Dr. B. D. Stacy.

In chronic obstructive jaundice pruritus is an almost constant feature, and its disappearance is a bad prognostic sign, indicating failure of liver function. Itching is transient in infectious hepatitis and absent in hæmolytic jaundice.

Pain in the form of colic is present in 75% of cases of stone in the common bile duct. Malignant jaundice is said to be classically painless and progressive, but pain is often present in these cases, although it is seldom a colic. Pain over the liver is present in 10% of cases of infectious hepatitis. It is absent in hæmolytic jaundice, unless due to pigment stones.

Weight loss tends to be more marked in carcinoma than in stone in the common bile duct, and in malignant disease loss of weight and general ill health often precede the jaundice.

TABLE I.
Clinical Features of the Types of Jaundice.

	Obstructive.		Hepatocellular. (Infectious Hepatitis.)	Hæmolytic. (Acholuric Jaundice.)
	Carcinoma.	Stone.		
Family history ..	−	−	−	±
Age	50 to 60 years.	30 to 40 years.	Usually younger.	Younger.
Sex	Usually male.	Usually female.	−	−
History of dyspepsia	−	+	−	−
Duration of symptoms.	Always less than one year.	May be a few years.	Short.	Long.
Onset of jaundice	Slow.	Slow.	Rapid.	Slow.
Trend of jaundice	Steadily deepens.	Fluctuates.	Deepens, then gradually fades.	Crises.
Pruritus	++	+++	Transient.	−
Pain	Not a colic.	Colicky.	− (+)	− (+)
Weight loss ..	+++	++	+	−
Fever	∓	±	Onset.	−
Constitutional symptoms.	±	−	+++	−
Pale stools ..	+	±	∓	−
Depth of jaundice	++++	+++	++	+
Palpable gall bladder	+	−	−	−
Palpable spleen ..	−	−	±	+
Urine	Bilirubin.	Bilirubin.	Excess urobilin + bilirubin.	Excess of urobilin.
Plain X-ray film of the abdomen.	−	±	−	−

Fever due to cholangitis is more common in stone than in carcinoma; it may be an intermittent high fever with rigors (Charcot's intermittent biliary fever). In infectious hepatitis there is fever in the early stages, subsiding with the onset of the jaundice.

Constitutional symptoms may be mild or absent in obstructive jaundice, and are due to the cause of the obstruction. In hepatocellular jaundice the patient feels ill; thus, in infectious hepatitis, constitutional symptoms such as malaise, fatigue, nausea, revulsion to food, etc., are well marked in the pre-icteric and early phases.

Pale stools are present if the biliary obstruction is complete. Consequently, the stools tend to remain pale in malignant jaundice once the obstruction is well established, but to vary in stone in the common bile duct, in which condition they are usually not pale for more than a few days. In infectious hepatitis they are never pale for more than three or four days. In hæmolytic jaundice they are dark.

In obstructive jaundice the skin may become deep greenish or brownish yellow, deeper in cancer than in stone. In hæmolytic jaundice the skin is lemon yellow, and in infectious hepatitis the colour is usually intermediate.

Courvoisier's law states that if in a jaundiced patient the gall bladder is enlarged, it is not a case of stone impacted in the common bile duct, for previous cholecystitis would have rendered the gall bladder fibrotic and incapable of distension. If the enlarged gall bladder can be felt clinically, there is little doubt that the jaundiced patient is suffering from a tumour involving the biliary passages. (Occasional exceptions to Courvoisier's law occur, such as pigment or cholesterol stones obstructing the common bile duct without fibrosis of the gall bladder; or more rarely double impaction, one stone blocking the common bile duct and another the outlet from the gall bladder; or pancreatic calculus may block the ampulla.) However, an enlarged gall bladder is not palpable clinically unless it is very grossly distended and tense. Therefore, failure to palpate the gall bladder is not usually significant, and in such a case the patient may be suffering from either stone or carcinoma. Moreover, the biliary obstruction may be caused by secondary deposits in glands in the hilum of the liver or other malignant disease above the confluence of the cystic and hepatic ducts.

The spleen is enlarged in acholuric jaundice, sometimes in infectious hepatitis, and often in portal and biliary cirrhosis.

Enlargement of the liver is often found in hepatocellular and obstructive jaundice, but the clinical features are not of great help in diagnosis except in the case of the hard irregular enlargement of advanced malignant disease. A small liver indicates severe hepatitis or portal cirrhosis, and excludes extrahepatic biliary obstruction.

The general physical examination includes a search for a tumour of the stomach, colon or elsewhere (e.g., a melanoma). In portal cirrhosis, spider nævi, palmar erythema, white nails, diminished pubic and axillary hair, dilated periumbilical veins, etc., may be found. Ascites, if found, is due to cirrhosis or to peritoneal carcinomatosis.

Rectal examination is important, and may reveal a primary carcinoma of the rectum or secondary deposits in the ovaries or pelvic floor.

Dark urine is the most sensitive clinical index of jaundice. Changes in the colour of the urine for better or worse precede those in the colour of the sclera and skin. The urine is often dark in subclinical jaundice, in which the sclera and skin are not apparently coloured, although the serum bilirubin level is slightly raised. An attack of abdominal pain which has been followed by dark urine is likely to have been biliary colic. As an over-simplification it may be said that in obstructive jaundice there is bilirubin in the urine, but no urobilin; in hæmolytic jaundice there is excess of urobilin, but no bilirubin; and in infectious hepatitis there may be excess of urobilin as well as bilirubin. The clinician may test for these pigments himself, or employ a pathologist. A tablet test, the "Ictotest", is a simple, convenient and sensitive test for bilirubin in the urine, as is Ehrlich's test for urobilinogen. Schlesinger's test for urobilin is a little more complicated.

A plain X-ray film of the abdomen may reveal stones in the gall bladder, or less commonly in the common bile duct or both, and these findings are presumptive evidence of calculous obstruction to the biliary passages. Unfortunately, gall-stones are radio-opaque in only 10% to 15% of cases, and a single stone in the common bile duct seldom throws a shadow. Occasionally, pancreatic calcification is revealed. The liver shadow may be enlarged in obstructive jaundice and hepatitis, and in portal cirrhosis it may be either large or small.

Cholecystography and intravenous cholangiography are ineffective because of poor secretion of the dye, and are contraindicated in the presence of jaundice, the dangers being liver damage and occasionally acute pancreatitis.

X-ray examination of the chest may reveal primary or secondary tumours, and irregularity or elevation of the right half of the diaphragm due to an enlarged or nodular liver.

Pathological Tests.

The hæmatological and biochemical changes in the types of jaundice are summarized in Table II. Hæmolytic jaundice is usually easily diagnosed (unless there is also biliary obstruction due to a pigment stone). Unfortunately, the distinction between hepatocellular and obstructive jaundice is not always as easy as perusal of Table II may suggest, as there is often an element of obstruction in hepatocellular jaundice, and often an element of liver damage in obstructive jaundice.

Undue significance should not be attached to the laboratory tests, and they should be regarded as aids and not alternatives to clinical assessment. Serial serum bilirubin estimations are valuable in determining the trend of the jaundice, and failure of the prothrombin index to respond to parenteral vitamin K therapy is an important warning that surgery should be avoided. Anæmia may indicate hæmolysis, cancer or cirrhosis.

Other Investigations.

Further tests are necessary in individual cases. The barium meal X-ray examination may reveal œsophageal varices, carcinoma of the stomach, or distortion of the duodenum due to a carcinoma of the head of the pancreas; in the last instance the case is a late one, and the diagnosis has usually been made already on other grounds. Sigmoidoscopy and an X-ray examination with a barium enema may reveal a carcinoma of the colon. The presence of occult blood in the stools suggests a carcinoma of the stomach, colon or periampullary region, or portal hypertension in a cirrhotic subject. The test meal may show achlorhydria, which is present in more than 25% of cases of carcinoma of the pancreas, as well as in most gastric neoplasms. Duodenal intubation may be used to determine whether bile and pancreatic enzymes are absent from the duodenal contents, and whether blood is present. The glucose tolerance test may reveal diabetes mellitus, a condition which in many cases precedes carcinoma of the pancreas. In this country the possibility of obstructive jaundice due to hydatid disease must be remembered, and appropriate tests carried out.

TABLE II.
Pathological Tests in the Investigation of Jaundice.

Test.	Obstructive.	Hepatocellular.	Hæmolytic.
Blood count	May be anæmia and leucocytosis.	Leucopenia; may be abnormal lymphocytes.	Anæmia, reticulocytosis, spherocytosis.
Coombs test	Negative.	Negative.	Positive in the acquired form.
Red cell fragility	Normal.	Normal.	Increased.
Bilirubin in urine	+	+	−
Excess urobilin in urine	−	+	+
Van den Bergh reaction[1]	Direct positive.	Delayed direct biphasic.	Indirect positive.
Serum bilirubin	+++	++	+
Serum albumin	Normal.	Low.	Normal.
Serum globulin	Normal.	Raised.	Normal.
Zinc sulphate, thymol turbidity, etc.	Normal.	Raised.	Normal.
Serum alkaline phosphatase	Usually more than 30 units per 100 millilitres.	13 to 30 units per 100 millilitres.	Normal.
Prothrombin index after vitamin K therapy.	Normal.	May be low.	Normal.

[1] The reaction is of value in the diagnosis of uncomplicated hæmolytic jaundice, but is of no value in the differential diagnosis of the other forms of jaundice.

Aspiration Liver Biopsy.

Dr. B. P. Billington has found aspiration liver biopsy of value, and has employed it on over 300 occasions. There is a small mortality due to bile peritonitis and hæmorrhage; as the risk is greatest in jaundiced subjects, the method should be restricted to cases which remain obscure after clinical and biochemical investigation.

Laparotomy.

Exploration of the abdomen often provides much more complete information than can be obtained by any other means. In recent years improvements in anæsthesia and in surgical management and technique have greatly lowered the mortality of laparotomy.

1. When there is obstructive jaundice apparently due to stone in the common bile duct, operation should as a rule be delayed, in the hope that the jaundice will subside. Exploration may then be undertaken later with greater safety. If, on the other hand, the jaundice persists, the stone

has evidently become impacted. In view of increasing liver damage, operation should be arranged without undue delay, especially if rigors indicate cholangitis. However, adequate time must be allowed for preparation with vitamin K etc.

2. When there is obstructive jaundice apparently due to malignant disease, and the jaundice is steadily deepening, exploration should always be considered, unless very advanced malignant disease can be diagnosed beyond reasonable doubt. In many cases of carcinoma, a valuable degree of palliation may be achieved by a short-circuiting procedure, and sometimes in periampullary growths a curative resection can be performed. On occasions the expected malignant disease is not found, but a benign condition such as stone in the common bile duct instead.

3. Doubt may exist as to whether the jaundice is hepatic or obstructive. If the jaundice is not getting better, and there is any doubt about diagnosis, laparotomy is indicated, provided the patient is well enough. Sometimes cases are labelled infectious hepatitis, and the jaundice is allowed to persist for a long period, when the cause is in fact obstruction. Meanwhile, progressive liver damage is occurring, and the patient's condition is deteriorating seriously. One may be asked how long a patient should be observed to decide whether the jaundice is diminishing. No rigid rule can be applied, as every patient is individual, but the state of doubt should be allowed to persist for no longer than a few weeks.

At laparotomy it is necessary to explore the abdomen generally because of the possibility of lesions such as carcinoma of the stomach or colon, but this must be done with extreme gentleness because of the danger of bleeding. The spleen and liver are examined, and it may be desirable to take a wedge of liver as a biopsy. The gall bladder is examined, and Courvoisier's law is recalled. The bile ducts may be explored by the supraduodenal methods, and finally the pancreas is inspected and palpated.

There is often difficulty in distinguishing between chronic pancreatitis and carcinoma. A small growth may obstruct the pancreatic duct, and produce nodularity and thickening throughout the whole gland, suggesting chronic pancreatitis. In fact, the diagnosis of chronic pancreatitis with obstructive jaundice must always be regarded with grave suspicion. Biopsy of the pancreas is attended by the risks of bleeding and fistula. Moreover, the tissue removed may not include portion of the tumour, and obstruction of the pancreatic duct by the growth may produce the histological picture of pancreatitis. The Vim-Silverman needle may be used to reduce the hazards of pancreatic biopsy, and an immediate or delayed pathological opinion may be obtained.

Operative Cholangiography.

Diagnostic operative cholangiography is the method of visualizing the bile ducts radiographically during the operation just before dissection of the biliary tract is begun. A radio-opaque medium such as diodone is injected into the cystic or common bile duct with a catheter or needle, and one or two films are taken and developed immediately. Although disappointing as a routine procedure, the method has proved useful in investigating obscure cases of obstructive jaundice.

Control or completion operative cholangiography is performed after the biliary passages have been explored and a tube has been inserted into the common bile duct to provide external biliary drainage. Before the abdomen is closed, opaque medium is injected down the tube and films are taken. This procedure may be usefully employed after exploring the bile ducts for stone, in an endeavour to make sure that all calculi have been removed.

Summary.

1. Carcinoma and stone in the common bile duct are common causes of jaundice, particularly in older people. Infectious hepatitis is also common, especially in younger patients.

2. The most valuable parts of the investigation are the history and physical examination, but undue reliance must not be placed on any one clinical feature.

3. Laboratory tests may be helpful, particularly in cases of hæmolytic jaundice. They should be regarded as aids and not as alternatives to clinical assessment.

4. The diagnosis must sometimes await observation of the progress of the case.

5. Occasionally, laparotomy becomes necessary as the only means of making the diagnosis. It is easy to accept without question an initial label of infectious hepatitis for too long, when the jaundice is in fact obstructive. Therefore, if the jaundice persists unduly and the diagnosis remains in doubt, exploration is indicated provided the patient is well enough.

EDWARD CORTIS.

Sydney.

British Medical Association.

AGREEMENT BETWEEN FEDERAL COUNCIL AND REPATRIATION DEPARTMENT.

ADVICE has been received that the new agreement between the Federal Council of the British Medical Association in Australia and the Repatriation Commission, for the treatment of widows, orphans and other eligible dependants of deceased ex-servicemen, came into operation on January 1, 1959.

Attention is drawn to the fact that the new service operates on a fee-for-service basis and that beneficiaries are required to sign the Repatriation Commission's vouchers to authorize payment to the medical officer.

Correspondence.

A NOTE ON HERPES ZOSTER AND VARICELLA.

SIR: Recently I saw a man, aged 73, who presented with herpes zoster involving segments of the right brachial plexus. On the third day of his illness varicella developed. The rash was profuse on back and trunk, but did not develop on face or scalp. Only a few vesicles developed on the right upper limb, whilst they were profuse on the left upper limb. The varicella ran its normal clinical course.

The coincidence and sequence of these conditions in the same patient would appear to be a *rara avis*.

Yours, etc.,

JOHN WATSON.

197 Malabar Road,
South Coogee,
New South Wales.
December 16, 1958.

ULCERATIVE COLITIS TREATED WITH "BEPANTHEN".

SIR: I was very interested in Dr. Grace Johnston's account of the treatment of a case of ulcerative colitis with "Bepanthen" (meeting of the British Medical Association at the Rachel Forster Hospital for Women and Children on March 20, 1958, MED. J. AUST., December 13, 1958, page 810).

The problem of ulcerative colitis cannot be simplified unfortunately, and anybody versed with this condition will agree that the chronic, relatively mild form is an entity entirely different as far as management, prognosis and especially emergency measures are concerned than the acute fulminating form complicating or succeeding the chronic form, and in which indisputably the only life-saving procedure is surgery.

However, I have tried myself intravenous injections of 500 milligrammes of pantothenic acid at weekly intervals in three relatively mild and chronic but radiologically and sigmoidoscopically confirmed cases of ulcerative colitis with good results.

To deduce that, in view of the improvement produced by administration of "Bepanthen" in cases of non-specific ulcers of the mouth, notoriously known to be caused by filtrable virus infection, the same treatment should be effective in ulcerative colitis is a "serendipity", so delightfully described by Dr. Clive Fitts. So is as well probably my own deduction of suspecting ulcerative colitis to be a metabolic disorder involving coenzyme A metabolism. Pantothenic acid is a component of the molecular structure of coenzyme A.

In spite of the excellent results with the injections of pantothenic acid, one must remember that the mild and chronic form of ulcerative colitis is a self-limiting disease,

and how much improvement was due to the administration of the drug or to the psychic effect of having treatment at all, it is difficult to assess.

It is reassuring to find Dr. Grace Johnston's results to be identical with mine, and I hope, for the sake of the patients afflicted with ulcerative colitis, that serendipity has again tricked logic. I wish on that occasion to express my thanks to Nicholas Pty. Ltd., who have produced the injections for me and made them available to me at cost price.

Yours, etc.,

7 Collins Street, Melbourne, C.1, Victoria.
December 16, 1958.

MICHEL BROUS.

ŒSOPHAGEAL HIATUS HERNIA.

SIR: Recent articles and letters, both here and abroad, have shown an interest in, and a searching for, an improved anatomical approach to the surgical treatment of œsophageal hiatus hernia.

No reference has been seen to a high epigastric incision with sternal splitting to the third or fourth interspace.

During the past few years a small personal series of such herniæ—nine primary and two recurrent—and one total gastrectomy have been completed by this method.

The direct access and easy working conditions in this region have been remarkable. There have been no relevant operative or post-operative complications. By contrast, a previous similar series, approached through a left thoracic, left subcostal, or high epigastric incision with excision of the xiphisternum, were conducted with much less facility.

Yours, etc.,

135 Macquarie Street, Sydney,
December 19, 1958.

JOHN HARDIE.

A REQUEST.

SIR: If I may inquire: in the case of a multipara who is suffering from a cardiac valvular lesion and is not in good health or circumstances, would it be correct to advise her as to the prevention of a pregnancy? And what should such advice be in relation to disabilities like the above or diabetes or liability to abortion? Is there a book suitable for such instruction to multiparæ?

Yours, etc.,

Bruny Island, Tasmania,
December 14, 1958.

G.P., TASMANIA.

MANGANESE AND MONGOLISM.

SIR: There is probably no aspect of mongolism which has received more attention than that of its causation, and many different theories regarding this have been advanced. The condition is one which has attracted a very large amount of attention, and contributions to our knowledge of it have been made by many observers in all parts of the world.

I was interested to read Dr. Cade's letter (MED. J. AUST., December 20, 1958), suggesting that a manganese deficiency may be the cause of mongolism. While any additional light that can be thrown on the ætiology of this condition is always welcome and it may well be that manganese deficiency might be a cause of mongolism, however, Dr. Cade's support of his theory is in my view quite unacceptable.

Firstly, mongolism is found the world over, in all peoples and races, whether or not they drink tea. Secondly, more often than not it is the third, fourth or last child who is a mongol. It would be difficult, if not impossible, to believe that the mother has changed her tea-drinking habits just at that particular pregnancy. Furthermore, even if the first child happens to be a mongol, it would take a lot of explaining why any subsequent children are normal; again, has the mother stopped drinking tea just then?

Finally, how would one explain binovular twins, one of whom is a mongol and the other normal? One could go on *ad infinitum* to refute Dr. Cade's proposition, but I think this will suffice.

Yours, etc.,

Reception House, Darlinghurst, New South Wales.
December 19, 1958.

E. FISCHER.

Naval, Military and Air Force.

APPOINTMENTS.

THE following appointments, changes etc. are published in the *Commonwealth of Australia Gazette*, No. 75, of December 11, 1958.

NAVAL FORCES OF THE COMMONWEALTH.

Citizen Naval Forces of the Commonwealth.

Royal Australian Naval Reserve.

Termination of Appointment.—The appointment of John Francis Walsh as Surgeon Lieutenant is terminated, dated 1st September, 1958.

Royal Australian Naval Volunteer Reserve.

Transfer to the Retired List.—Surgeon Lieutenant-Commander Samuel Edward Lees Stening, D.S.C., is transferred to the Retired List, dated 31st March, 1958.

AUSTRALIAN MILITARY FORCES.

Citizen Military Forces.

Southern Command.

Royal Australian Army Medical Corps (Medical).—The regimental seniority of 3/50211 Lieutenant-Colonel P. Kaye is next after 3/92021 Lieutenant-Colonel W. Rosenthal.

Western Command.

Royal Australian Army Medical Corps (Medical).—5/26563 Captain (provisionally) F. G. Daily relinquishes the provisional rank of Captain, 9th October, 1958, is transferred to the Reserve of Officers (Royal Australian Army Medical Corps (Medical)) (Western Command) and is granted the honorary rank of Captain, 10th October, 1958.

Reserve Citizen Military Forces.

Royal Australian Army Medical Corps (Medical).

The following officers are placed upon the Retired List (Northern Command) with permission to retain their rank and wear the prescribed uniform, 31st October, 1958: Major W. J. Arnold and Captain J. M. O'Connor.

ROYAL AUSTRALIAN AIR FORCE.

Permanent Air Force.

Medical Branch.

Flight Lieutenant John Edward Stacey Alwyn (04778) is transferred from the Reserve and appointed to a short-service commission, on probation for a period of twelve months, 4th June, 1958.

The following are appointed to a short-service commission, on probation for a period of twelve months, with the rank of Flight Lieutenant: David Paul Adamson, M.B.E. (0310768), 18th July, 1958; Evan Brian Morgan (0310769), Robert Carey Hicks (0310770), 25th July, 1958; Phillip Aldworth Mead (0310771), 11th August, 1958; David Colin Mintz (0310772), 5th September, 1958; Cyril Thomas Flynn (0310773), 10th September, 1958; Douglas Edward Charlton (0219360), 16th September, 1958, with seniority as from 16th September, 1954.

The short-service commission of Flight Lieutenant S. A. Ward (039983) is extended to 1st May, 1960.

Air Force Reserve.

Medical Branch.

The following are appointed to a commission with the rank of Flight Lieutenant: Bernard McCarthy O'Brien (257990), 28th May, 1958; Robert Edward Taylor Duhig (277668), 22nd July, 1958.

The World Medical Association.

MEDICAL EDUCATION CONFERENCE.

MEDICAL EDUCATORS from more than 62 countries will meet at the Palmer House, Chicago, Illinois, from August 30 to September 4, 1959, to exchange information and consider the problems of graduate, post-graduate and continuing education for the doctors of the world.

"Medicine: A Lifelong Study" will be the theme of the Second World Conference on Medical Education organized and sponsored by the World Medical Association in collaboration with the World Health Organization, the International Association of Universities and the Council for International Organizations of Medical Sciences.

The Programme Committee has invited approximately 125 speakers from more than 55 countries to present papers and has planned the programme with a view to devoting adequate time for discussion on each topic. Simultaneous translation in English, French and Spanish will facilitate the exchange of ideas among the world's leading medical educators, investigators and practitioners as they seek efficient application of medical methods for assisting every doctor to increase his knowledge of medicine concomitantly with the rapid advances in medical science.

In addition to the didactic programme, the American Medical Association and Association of American Medical Colleges, as Conference hosts, are offering pre-convention and post-convention tours to various centres of medical education. During the conference week, the five medical schools in the Chicago area will be open for observation and comparison by the conference participants. These schools represent the three prevalent systems in the U.S.A. for providing medical education—namely, schools owned and operated by non-governmental and non-religious associations, those with religious ownership and operation, and those under governmental management.

A technical and scientific exhibit will feature the most recent educational aids and methods. Scientific advances in technology and the psychology of education will be combined to demonstrate the effectiveness of their application in medical education.

The social programme is being planned to facilitate personal contact between the participants and provide opportunity for informal exchange of ideas.

Notice.

THE CHILDREN'S MEDICAL RESEARCH FOUNDATION OF N.S.W.

THE following is a list of donations to the Children's Medical Research Foundation of N.S.W. received from members of the medical profession in the period December 11 to 18, 1958.

Dr. J. C. A. Davies, Dr. J. A. Gatenby, £10 10s.

Dr. C. W. Dun, £10.

Dr. H. E. Goodman, Dr. K. Coventry, £5 5s.

Dr. A. Hellestrand, Dr. S. Bray, £5.

Previously acknowledged: £7769 6s. 9d. Total received to date: £7820 16s. 9d.

Medical Appointments.

Dr. R. N. Reilly has been appointed Honorary Surgeon in the Ear, Nose and Throat Department at the Royal Adelaide Hospital, Adelaide.

Dr. R. E. Gristwood has been appointed Honorary Assistant Surgeon in the Ear, Nose and Throat Department at the Royal Adelaide Hospital, Adelaide.

Dr. G. I. Brown has been appointed Honorary Clinical Assistant in the Dental Department at the Royal Adelaide Hospital, Adelaide.

Dr. A. D. Lamphee has been appointed Honorary Consulting Anæsthetist at the Royal Adelaide Hospital, Adelaide.

Dr. D. O. Tonkin has been appointed Honorary Clinical Assistant in the Ophthalmological Department at the Royal Adelaide Hospital, Adelaide.

Dr. G. H. Jones has been appointed Honorary Radiologist (with the status of Honorary Assistant) at the Queen Elizabeth Hospital, Adelaide.

Deaths.

THE following death has been announced:

GARDINER.—Samuel Stoops Gardiner, on December 19, 1958, at Newcastle.

Diary for the Month.

JAN. 13.—New South Wales Branch, B.M.A.: Council Quarterly.
JAN. 19.—Victorian Branch, B.M.A.: Finance, House and Library Subcommittee.
JAN. 20.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
JAN. 22.—Victorian Branch, B.M.A.: Executive of the Branch Council.
JAN. 23.—Queensland Branch, B.M.A.: Council Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Medical Secretary, 135 Macquarie Street, Sydney): All contract practice appointments in New South Wales. Anti-Tuberculosis Association of New South Wales. The Maitland Hospital.

South Australian Branch (Honorary Secretary, 80 Brougham Place, North Adelaide): All contract practice appointments in South Australia.

Editorial Notices.

ALL articles submitted for publication in this Journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given: surname of author, initials of author, year, full title of article, name of journal, volume, number of first page of the article. The abbreviations used for the titles of journals are those adopted by the Quarterly Cumulative Index Medicus. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors submitting illustrations are asked, if possible, to provide the originals (not photographic copies) of line drawings, graphs and diagrams, and prints from the original negatives of photomicrographs. Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary is stated.

All communications should be addressed to the Editor, THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2-3.)

Members and subscribers are requested to notify the Manager, THE MEDICAL JOURNAL OF AUSTRALIA, Seamer Street, Glebe, New South Wales, without delay, of any irregularity in the delivery of this Journal. The management cannot accept any responsibility or recognize any claim arising out of non-receipt of journals unless such notification is received within one month.

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